PTEMBER, 1947 TWO SHILLINGS

Plastics

ALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

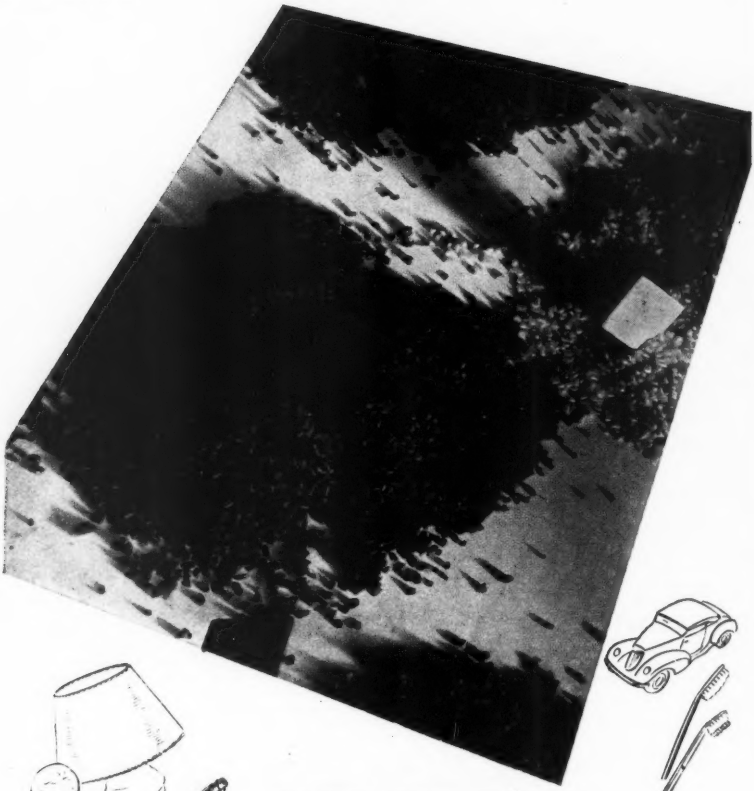
R BY
SEP 29 1947

COLOUR IN CASEIN

ERINOID LIMITED

Manufacturers of Modern Plastics Materials

LIGHTPILL MILLS · STROUD · GLOUCESTERSHIRE



FIDELITY . . .

The complete fidelity of reproduction of injection mouldings from "Bexoid" Moulding Powder (seen above) is typical of the high standard of the whole range of BX Thermo-plastic materials. This includes "BEXOID" (Cellulose Acetate), "XYLONITE" (Celluloid), BX P.V.C. (Polyvinyl Chloride), BX POLYSTYRENE, "LACTOID" (Casein), BX ETHYL CELLULOSE and "ISOFLEX" (Light-weight Thermal Insulation).

BX

LEADERS IN THERMO-PLASTICS

HEAD SALES OFFICE :

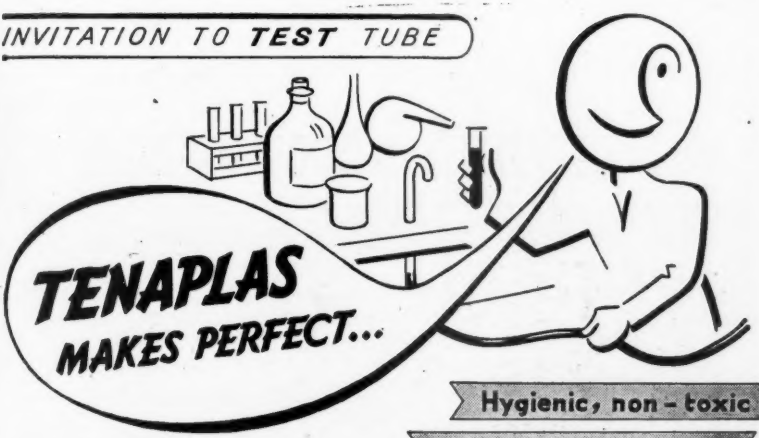
BX PLASTICS LTD., HIGHAM STATION AVENUE, LONDON, E.4

'Phone : LARkswood 4491.

AREA SALES OFFICES : King Street Buildings, 1, Ridgefield, Manchester 2. *Telephone : Manchester Blackfriars 0258.* 42, Wellington Street, Sheffield. *Telephone : Sheffield 25517.* 48, Moor Street, Birmingham 4. *Telephone : Midland 0132.*

WORKS : LONDON, MANNINGTREE, DUNDEE.

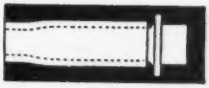
INVITATION TO ***TEST*** *TUBE*

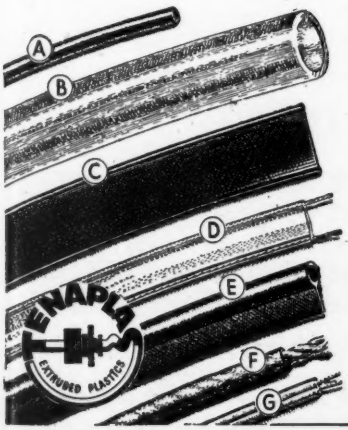


Hygienic, non-toxic odourless tubes for conveying most liquids

TENAPLAX is the name of this Tenaplas triumph in plastic extrusion. Odourless, non-toxic, hygienic—its glass-smooth finish keeps it permanently clean. Non-inflammable. Imperishable. And remarkable for tensile strength. It gives constant electrical insulation — withstands temperatures from —20°C. to +75°C. — resists almost all acids and corrosives under normal temperatures. In laboratory or factory — put TENAPLAX on trial. And count its many blessings!

● *TENAPLAX is made in continuous extruded lengths. The only jointing is at actual connecting point. Diagram on right shows end of tubing over tight-fitting Tenaplax connector.*





TENAPLAS PRODUCTS INCLUDE

(*a*) **TENATUBE** for wire sleeving; delivery of liquids.
(*b*) **TENAPLAX** for conveying liquid foodstuffs and chemicals.
(*c*) **TENATAPES** for haberdashery and trimmings.
(*d*) **TENAWIRE** Twin Flat; single and multiple.
(*e*) **TENATRIMS** for motor-car coachwork and upholstery.
(*f*) **TENAROPE** for clothes-lines, sash cord and many other uses.
(*g*) **TENAWIRE** Twin Flex, and other wires for many uses.

Tenaplas
Extruded Plastics
IN ANY DIMENSIONS REQUIRED

TENAPLAS LTD • UPPER BASILDON • Nr. PANGBOURNE • BERKS.

Phone: Upper Basildon 228 & 269 • Cables: Tenaplas, Reading • Code: Bentley's, 1st Edition • Agents throughout the world

T.P.8F

★ NEW AND SECONDHAND

HYDRAULIC PRESSES

PUMPS AND ACCUMULATORS

Machinery for Rubber and Plastic Industries

PETROL AND DIESEL GENERATING SETS

Electric Motors, Switchgear, etc.

★

STEAM BOILERS of all types

PUMPS · MACHINE TOOLS · WOODWORKING MACHINES

and everything for your Works

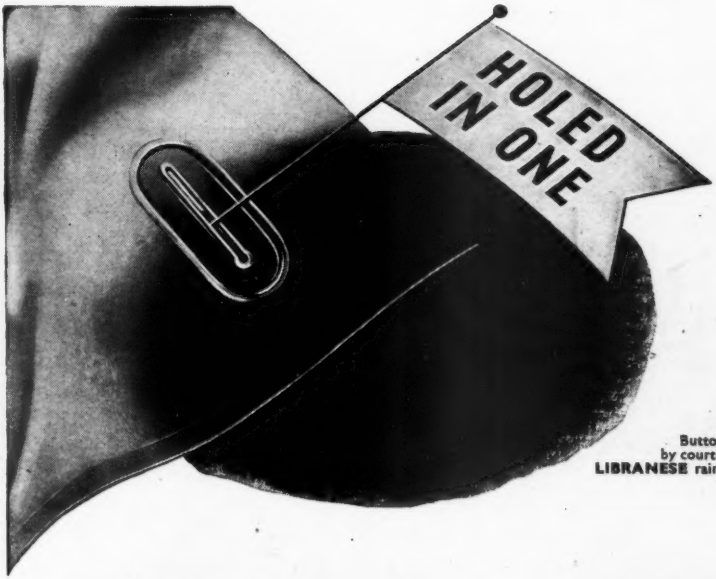
GEORGE COHEN, SONS & CO. LTD

WOOD LANE · LONDON · W.12 AND STANNINGLEY · LEEDS

And at BIRMINGHAM, NEWCASTLE, GLASGOW, SOUTHAMPTON, BATH, SHEFFIELD, MANCHESTER, SWANSEA, BELFAST, etc.

ONE OF THE 600 GROUP OF COMPANIES

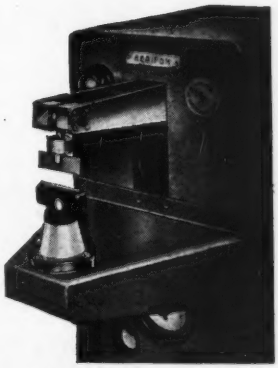
4/1/1302



Buttonhole
by courtesy of
LIBRANESE raincoats

Button-holing plastic clothing is a mere 2-second operation with the Redifon JP-1 plastic welder — but that's not all. This flexible machine can be adapted to all aspects of plastic clothing fabrication — it can weld complicated seams, and weld them quickly so that the joint is stronger than the surrounding material. No holes for water to leak through—no threads to tear—altogether a cleaner, neater and faster job.

Button-hole your production manager and ask him what a battery of JP-1's could do in your production line.



Business end of the JP-1 plastic welder, one of a wide range of REDIFON industrial heaters. The size and shape of the electrodes may be changed to suit the job.

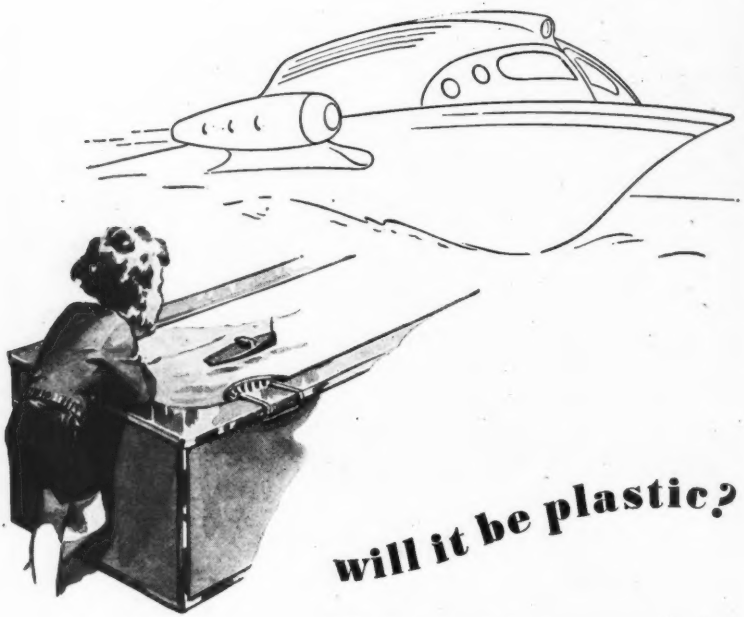
Redifon **HEATING**

INDUSTRIAL ELECTRONIC DIVISION

REDIFFUSION LTD., BROOMHILL RD., LONDON, S.W.18

Designers and Manufacturers of Industrial Electronic and Radio Communication Equipment.

Scientific RH 104



will it be plastic?

Will he, when he's grown to be a man, skipper a man-size craft that's plastic stem to stern? Will he sit beside a plastic hearth, spin his yarns from a plastic chair, wear a suit that's woven of plastic thread? Ask the public. "Everything's going to be plastic soon," they say. Ask us — whose business is the development of plastic materials for every branch of industry. We say this: Flint gave way to bronze. Materials familiar to us now will in time undoubtedly give way to plastics. But plastics are not wood, nor metal, nor glass, nor rubber — plastics are plastics and proud of it! That is why our research and technical departments are putting plastics to work where they are not only the least expensive but also the best materials for the job in hand.

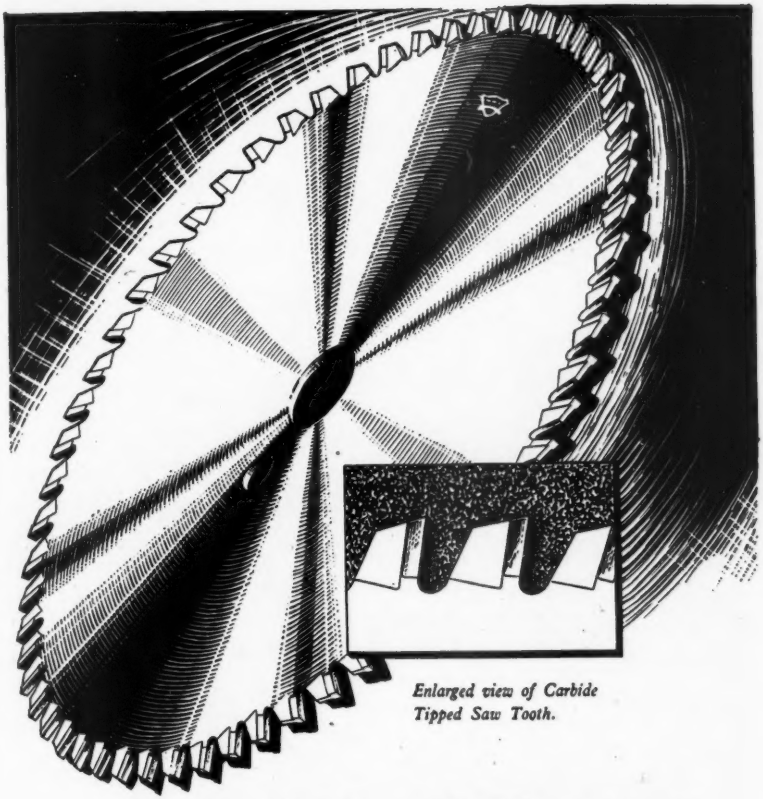
Ask **BRP** *about Plastics*

BRITISH RESIN PRODUCTS LIMITED

Consolidating all plastics manufactures and sales hitherto carried out by: F. A. Hughes & Co., Limited
Indurite Moulding Powders Limited · Cellomold Limited · Extruded Plastics Limited

Sales Office: Abbey House, Baker Street, London, N.W.1 · *Telephone:* **Welbeck 2332/6**

Works: Tonbridge · Feltham · Radcliffe · *Barry (under construction)*



Enlarged view of Carbide Tipped Saw Tooth.

Abrasion abdicates

The cutting of plastic and plastic bonded materials causes rapid blunting of cutting edges and calls for large stocks of tools. Sagar carbide tipped saws, knives and solid cutters banish the abrasion bogey, last longer between sharpenings, cut more quickly with a fine finish and waste less material. Plastic sheeting is kept safe from shattering and the keen cutting maintains the necessary coolness in thermo-plastics. We shall be glad to demonstrate how Sagar Carbide Tipped Tools can speed production and cut costs.

SAGAR (DEVELOPMENTS) LTD

CANAL WORKS · HALIFAX

LONDON · BIRMINGHAM

The Greatest advance ever made in PLASTICS-PRESS DESIGN!

* Independent THERMOSTATIC CONTROL for each hotplate, with thermometers to indicate temperatures.
* BUILT-IN INTERVAL TIMER, to ensure accurate and uniform timing.
* ELECTRICAL SWITCHGEAR & CONTROLS totally enclosed for safety.
* RE-SETTING MECHANISM for bottom ejectors, can be operated without moving the ram.
* ONE LEVER controls both opening and closing movements of the press.
* MECHANICALLY INTERLOCKED SAFETY GUARDS.
* Totally enclosed HYDRAULIC SYSTEM prevents ingress of moulding flash, dust, etc.

No other Press has all these advantages!

The Turner Plastics Press is completely self-contained. It provides any required pressure between 10 and 50 tons, and is installed by making a single connection to the electrical supply. Fully descriptive literature gladly sent on request.

★MOULD DESIGN & MANUFACTURE

We offer a highly skilled service in the design and manufacture of precision moulds for Injection, Compression and Transfer moulding. Let us give you full details.

The TURNER PLASTICS PRESS

TURNER MANUFACTURING CO. LTD., WULFRUNA WORKS, VILLIERS STREET, WOLVERHAMPTON

WE ENTER THE RESIN FIELD

THE OIL obtained during the low temperature carbonisation of coal by the "COALITE" Process contains a very large proportion of phenols and some of these are peculiarly suited to the manufacture of phenolic resins.

PLANT is now under construction for the manufacture of a range of straight and modified phenolics, and until erection is complete we shall not be able to execute bulk orders. Already, however, samples of some of these products are available from our pilot plant, and enquiries for lots of up to 50 lbs. are invited.

"RESINUM" No. 40

(*Regd. Trade Mark*)

Oil-soluble modified

"RESINUM" No. 60

(*Regd. Trade Mark*)

Alcohol-soluble, 100% phenolic

"RESINUM" No. 70

(*Regd. Trade Mark*)

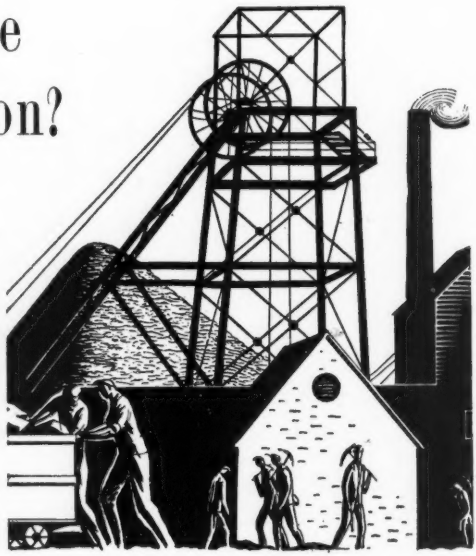
High m.p.t. Alcohol-soluble, 100% phenolic

Enquiries should be addressed to :

LOW TEMPERATURE CARBONISATION LTD.

HEAD OFFICE: 82, VICTORIA STREET, LONDON, S.W.1.

Who first shed electric light on the Coal Question?



How pleased the miners in Pleasley Colliery must have been when Colonel Crompton installed, not only the first electric light in the underground workings, but the first flame-proof switchgear. That was in 1881. This installation was destined to become one of the most important contributions to miners' welfare and safety. This was only one of Crompton's brilliant achievements. He electrified the Opera House in Vienna, railway trains, docks, lightships and cathedrals. He, too, first introduced house-to-house lighting in England.

Today, the great organisation of Crompton Parkinson Ltd., carries on the pioneering spirit of Colonel Crompton in the field of electric lighting development. Never was their experience and knowledge more needed than in today's 'battle for output.'

Crompton *LAMPS & LIGHTING EQUIPMENT*

FOR THE LATEST IN LIGHTING

CROMPTON PARKINSON LIMITED, ASTOR HOUSE, ALDWYCH, LONDON, W.C.2

Telephone : CHAncery 3333. *Telegrams : Crompark, Estrand, London*

Interested in Laminates?

FACTS WORTH KNOWING ABOUT PERMALI

PERMALI is a fully impregnated, densified, laminated wood. It is available in the form of flat or curved sheets, rods or machined parts. Of great value as an electrical insulating material where mechanical strength is required, Permali is also widely used for general engineering purposes where a high strength-weight ratio, machinability, or resistance to weathering and corrosion are important.

Machinability

Permali may be sawn, planed, turned, drilled and tapped on standard machine-tools.

Dimensional Stability

Permali is highly resistant to moisture, oil, mild acids and alkalis, and remains dimensionally stable under normal working conditions.

Electrical Strength

The combination of great mechanical and electrical strength offers many advantages to the designer of insulating components which are subject to heavy mechanical stress.

High Strength-Weight Ratio

Half the weight of aluminium, with a tensile strength of 12 tons p.s.i., Permali is an ideal material where strength and lightness are both essential.

Resistance to Heat

Permali remains unaffected by exposure to temperatures up to 100°C.

PROPERTIES OF PERMALI

Electrical Strength = 100 volts/mil.

Impact Strength = 5.5 ft.-lb.

Tensile Strength = 28,000 p.s.i.

Compressive Strength = 30,000 p.s.i.

Specific Gravity = 1.28 — 1.32

FREE DATA BOOK

Write now to secure your copy of the Permali Data Book B8 giving full details and sizes of this useful material.

PERMALI

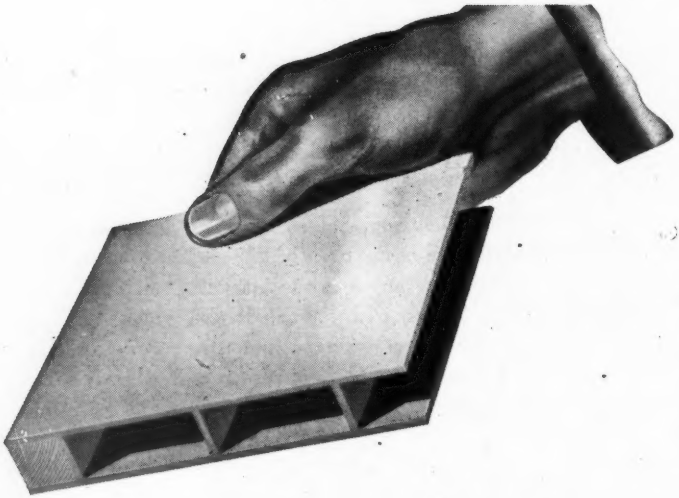
Laminated · Impregnated · Densified

PERMALI

THE NEW INSULATION CO., LTD., GLOUCESTER. TELEPHONE 4941.

11821

B



THIS is no substitute

It started as wood; and in its processing it has acquired a hardness and rigidity unobtainable in its natural state. Hitherto, laminated plastics have provided a decorative skin, relying on a foundation material for support. "Holoplast" combines the structural base with the decorative effect in a single homogeneous unit.

Its easy manipulation and speed of erection save many man-hours.
It is vermin-proof and hygienic.
It is resistant to oils and dilute acids.
It can be cut, sawn, drilled, routed, planed, etc., by normal joinery tools.
It is fire-retarding — it neither supports combustion nor spreads flame.
Available in standard panels 8′ x 4′ x 1″ overall in natural brown, cream-sprayed or veneered surface.

Full information about "Holoplast" laminated structural plastic is obtainable from the manufacturers or the distributors.

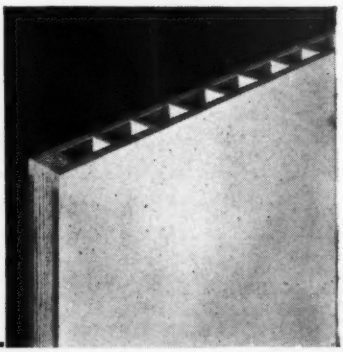
HOLOPLAST LTD.

NEW HYTHE, Nr. MAIDSTONE, KENT

London Office : 68, Victoria Street, S.W.1
Telephone : Victoria 9981

AUTHORISED DISTRIBUTORS FOR THE UNITED KINGDOM:—

Metropolitan Plywood Company
Venesta Ltd.
Denny, Mott & Dickson Ltd.
Gabriel, Wade & English Ltd.
Gliksten Plastics
L. Kelzer & Co. Ltd.



C.M.13

Point TWO

IN CONSIDERING PLASTICS

FIT FOR THE JOB? Your plastic component will be fit for the job if you consult Moulders of the widest experience such as Crystalate.

Co-operation in the early stages of the design of the piece is important.

Modern plastic materials are infinite in their variety and characteristics and to consult specialists is but a simple precaution in the interests of ultimate satisfaction.

Crystalate's " fit for the job " moulding service will clarify all difficult points for you.

CRYSTALATE

PLASTIC MOULDERS & TOOLMAKERS SINCE 1899

Crystalate Ltd., Golden Green, Tonbridge, Kent. Phone: Hadlow 233/4/5 (20 lines).

MOULDED PRODUCTS LTD

Pioneers in the Plastic Field, there is no class of moulding which Moulded Products Ltd. cannot undertake, and after years of practical experience an organisation of designers, research workers and skilled technicians has been established, which is superbly equipped to meet the specialised needs of manufacturers who require plastic parts or accessories of the highest quality finish, within precision limits, at economically competitive prices.

Send us your enquiries

A Technical Representative is available to discuss moulding problems at your own premises, if desired.

MOULDED PRODUCTS LTD CHESTER ROAD · TYBURN · BIRMINGHAM

READ THE STOP PRESS

3,500-ton John Shaw **SHEET MOULDING PRESS,** table 9′ x 5′.

2,000-ton John Shaw **MOULDING PRESS,** table 7′ x 3′.

1,000-ton DOWNSTROKE MOULDING PRESS by Rice & Co., Ltd., table 6′ x 4′.

780-ton MOULDING PRESS, table 6′ x 4′.

400-ton DOWNSTROKE MOULDING PRESS by John Shaw & Sons, table 4′ 6″ x 4′.

Three **300-ton UPSTROKE MOULDING PRESSES** by John Shaw & Sons, table 2′ 9″ square.

Two **200-ton MOULDING PRESSES** by Hydraulic Engineering Co., table 25″ x 30″.

OF REED'S STOCK PRESSES

Also many Smaller Presses, Pumps and Plastic Plant of all types, both New and Secondhand.

We are Specialists in Plastic—Chemical—Rubber Machinery

also for Dismantling, re-erecting and installing single items or complete plants.
Designing and making Special Machines to particular needs.
Welding repairs, and fabrication of complete machines or parts.
Maintaining and repairing equipment.

Send your enquiries to:

REED BROTHERS (ENGINEERING) LTD.

BEVIS MARKS HOUSE, LONDON, E.C.3.

Telephone: AVEnue 1677/8.
Telegrams: Replant, Ald, London.

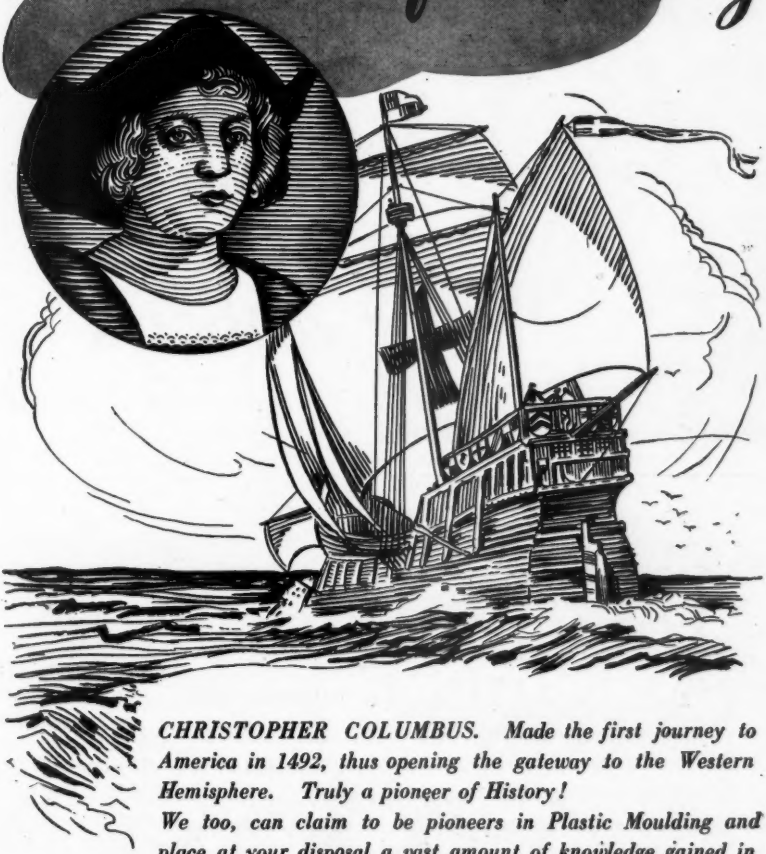
Plastic Mouldings of any description

Whether you require Ash Trays, Dice Tumblers, or Mouldings of more intricate nature, we invite your enquiries.

ROOTES
Mouldings Ltd

SLOUGH, BUCKS Telephone: Slough 22349

Pioneers of History



CHRISTOPHER COLUMBUS. Made the first journey to America in 1492, thus opening the gateway to the Western Hemisphere. Truly a pioneer of History!

We too, can claim to be pioneers in Plastic Moulding and place at your disposal a vast amount of knowledge gained in the hard school of experiment and experience.

Bring your moulding problems to us. All enquiries treated in the strictest of confidence.

ROBERT McARD & CO. LTD.

CROWN WORKS · DENTON · MANCHESTER

Pioneers IN MOULDED PLASTICS

Tenite

is tough
and pleasant to handle

For technical information, literature and moulding samples, write to :

T.E.C. PRODUCTS DIVISION

KODAK LTD.

WEALDSTONE · HARROW · MIDDLESEX
Tel. : HARrow 4380. Ext. : 27.

With acknowledgements to The Rover Co. Ltd. and Morris Motors Ltd. Rims moulded by Wilmot-Breeden Ltd.

BUSINESS EFFICIENCY EXHIBITION

for better management in office and factory

Empire Hall, OLYMPIA, London
October 1 — October 11, 1947

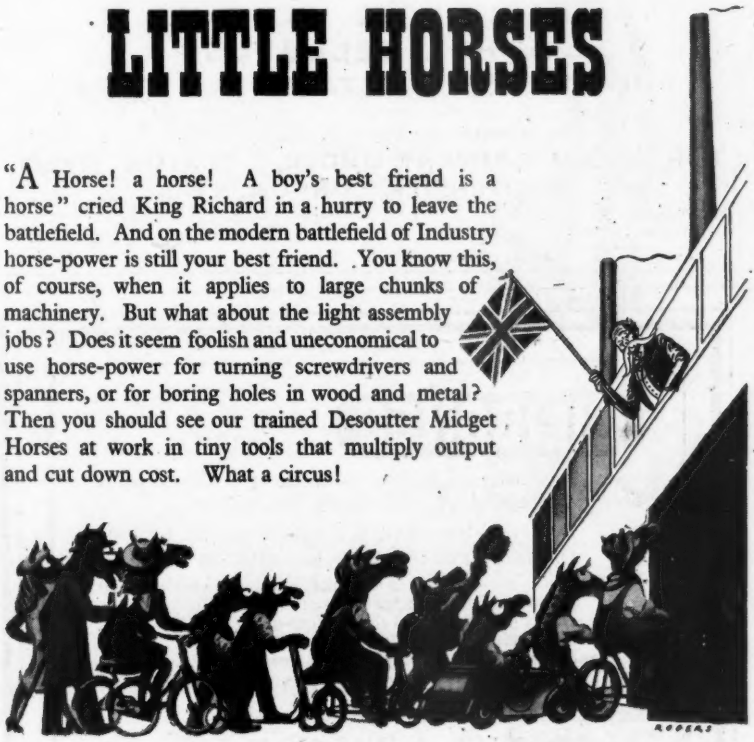
Organised by the Office Appliance Trades Association of Gt. Britain and Ireland, 11-13 Dowgate Hill, Cannon Street, London, E.C.4.

OPEN from 10 a.m. - 8 p.m. daily (Except Sunday)

Issued by Desoutter Bros. Ltd. The Hyde, Hendon, London, N.W.9. Tel: Colindale 6346-7-8-9

Call up the LITTLE HORSES

"A Horse! a horse! A boy's best friend is a horse" cried King Richard in a hurry to leave the battlefield. And on the modern battlefield of Industry horse-power is still your best friend. You know this, of course, when it applies to large chunks of machinery. But what about the light assembly jobs? Does it seem foolish and uneconomical to use horse-power for turning screwdrivers and spanners, or for boring holes in wood and metal? Then you should see our trained Desoutter Midget Horses at work in tiny tools that multiply output and cut down cost. What a circus!



DESOUTTER *Specialists in Lightweight, Pneumatic & Electric Portable Tools*

C.R.C. 175

C

Competitive Export

Competition in overseas markets is keen. To meet the situation raw materials moderate in price and finest in quality must be purchased from reliable sources.

Subject to use in manufactured goods for export, we are in a unique position to fulfil these conditions.

Grade 1 Virgin Moulding Compounds are offered in :—

POLYETHYLENE
CELLULOSE ACETATE
ETHYL CELLULOSE
CELLULOSE ACETATE BUTYRATE

Please address enquiries to CANADIAN DIVISION

R. H. COLE & COMPANY LIMITED, 2 CAXTON STREET, WESTMINSTER, LONDON, S.W.I.

Telephones: WHITEHALL 0711/2/3.

Telegrams : GERATOLE, 'PHONE, LONDON.

SILICONES

Silicone products manufactured by the Dow Corning Corporation are now available in this country. They include :

D.C. SILICONE FLUIDS D.C. SILICONE RESINS
D.C. SILICONE GREASES D.C. SILASTIC RUBBER

Stocks are sufficient to meet demands for sample and trial purposes. Further supplies are on the way. (Enquiries for D.C. stopcock greases and Silicone fluids for high vacuum diffusion pumps should be addressed to Messrs. W. Edwards & Co., Kangley Bridge Road, Lower Sydenham, S.E.26, who are the sole distributors of these particular products.)

For all other Silicone compounds please apply to

ALBRIGHT & WILSON Ltd

Distributors of Dow Corning Silicones

49 PARK LANE, LONDON, W.I. *Phone: Grosvenor 1311*

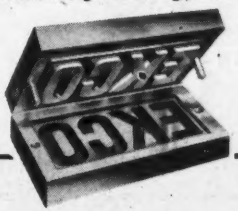
TBW/28L

Combined Operations...

...by EKCO

This ingenious 'Eralite' kettle combines both spout and handle in one moulding, which must be resistant to steam and boiling water. There is also a very neat piece of insetting at either end. We take such demands in our stride. Precision Mouldings are meat and drink to us, and the harder the problem the greater our enthusiasm. We have the experience, the technicians and the plant — in short, the "know-how"— to tackle any practical proposition in Thermosetting Moulding; and if your particular job *isn't* practical, we'll tell you.

EKCO PRECISION MOULDINGS FOR INDUSTRY



E. K. COLE LTD.

PLASTICS DIVISION · EKCO WORKS · SOUTHEND-ON-SEA

Expand quicker...

Use our plant and experience— Six factories for pulverising, mixing and grading of raw materials. We may introduce improved methods and materials.

DOHM LTD

167 VICTORIA ST.
LONDON, S.W.1
Telephone:
Victoria 1414/5/6
and Victoria 7913
SIX FACTORIES

PAPER---

UNITED PLASTICS & CHEMICALS (LONDON) LTD.

Sole Distributors in U.K. for
SYNTHETIC RESINS LTD.
of GALT, ONTARIO, CANADA

THERMO-PLASTIC MOULDING POWDERS
Cellulose Acetate and Polystyrene
Cellulose Aceto-Butyrate
Ethyl Cellulose.

CELLULOSE ACETATE AND CELLULOSE NITRATE
Sheet, Rod, Tube.

THERMO-SETTING MOULDING POWDERS
PHENOL AND UREA FORMALDEHYDE
and Phenol Resins.

73, HIGHGATE ROAD, KENTISH TOWN, LONDON, N.W.5.
Telephone . . . . . Gulliver 5466

SALES AND SERVICE

T. H. & J. DANIELS LTD. AH FRANCIS SHAW & CO. LTD.

PLASTICS EQUIPMENT

Plastics Machinery and Equipment

Shaw ⅜ oz. Thermo-Plastic Hand-operated Injection Moulding Machine.

THE BRITISH PLASTICS FEDERATION LIMITED

18838

We supply a complete range of machinery and equipment, including :

HYDRAULIC MOULDING PRESSES
INJECTION MOULDING MACHINES
TRANSFER MOULDING PRESSES
MIXING AND CALENDERING MACHINES
PREFORMING MACHINES
PRE-HEATING OVENS
EXTRUDING MACHINES
HOBBING PRESSES
HYDRAULIC PUMPS, VALVES AND CONTROL GEAR
MOULDS AND DIES
MOULD AND DIE-MAKING MACHINES
SPECIAL MACHINERY

We are also prepared to undertake the hobbing of dies.

Catalogues, schemes and estimates on request.

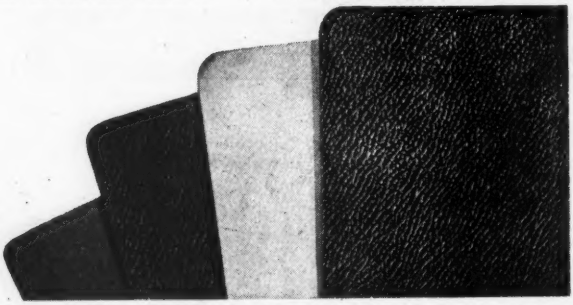
Please send enquiries to :

ALFRED HERBERT LTD · COVENTRY

SOLE AGENTS FOR PLASTICS MACHINERY IN GREAT BRITAIN, INDIA, FRANCE AND ITALY FOR
T. H. & J. DANIELS LTD., STROUD. **FRANCIS SHAW & CO. LTD., MANCHESTER**
REED PRENTICE CORPORATION, WORCESTER, MASS., U.S.A.

E

DURAPLEX P.V.C. LEATHERCLOTH



Duraplex Leathercloth is 'scuff' proof, hard wearing and resistant to sea-water, oils, alkalis and most acids. Duraplex is impervious to oxidisation and it is also resistant to prolonged exposure to the weather. Duraplex cannot be soiled by oil or grease and stains are easily removed by warm soapy water. Duraplex is resistant against corrosive atmosphere and heat resistance is sufficiently adequate for all practical purposes. Duraplex abrasive resistance and flex life is superior to leather. Produced in a wide range of colours, going to the full depth of the material.

DURAPLEX P.V.C. SHEETING

Manufactured in thicknesses between 6-8 thou" in Translucent and Opaque. Unlimited colour range.

With its wide range of colours makes it ideal for printing in attractive colours and designs. Duraplex sheeting has a beautiful smooth texture and drapes gracefully in all lengths. *Immediate Delivery.*

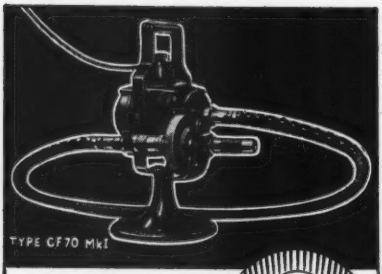
DURAPLEX (PLASTICS) LTD.

Burwood House, Caxton Street, London, S.W.1.

Telephone: WHitehall 2980 & 2989 *Grams:* POLYVYN, SOWEST, LONDON

Preheating of Plastics by
INFRA-RED LAMPS
G.E.C. Infra-Red Lamp Heating is being used with marked success in the manufacture of plastic moulded products of all kinds.
In the rapid and uniform softening of plastic sheet and strip or for the drying of plastic powder prior to moulding or punching, Infra-Red Heating has a definite contribution to make to the speed and efficiency of your production line.
FOR ALL INFRA-RED HEATING CONSULT THE
G.E.C.

Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2.



POWER BEHIND THE CRAFTSMAN

MORE POWER TO YOUR ELBOW

Ample power—much more than is available with other types of hand-held equipment—can be applied to Flextol Shaft-driven Tools.

DESIGN

Flextol Power-driven Hand Tools are the result of careful study of modern production requirements, and special attention has been given to ensure maximum speeds of operation and dependability.

RANGE

Interchangeable Handpieces, Attachments and Accessories are available to cover the widest possible range of operations, including Grinding, Disc Sanding, Polishing, Wire Brushing, Scaling, Filing, Screwdriving, Nut Setting, etc.

SERVICE

Our Technical Staff will gladly assist in solving production problems. Advice is based on over 20 years' unparalleled experience of Power-driven Hand Tools.

TYPE R.9 handpiece with 9 in. sanding disc attachment.

TYPE R.9 handpiece with 5 in. cup grinding wheel.

TYPE D.70 drilling handpiece with side handle, feed screw and spade handle.

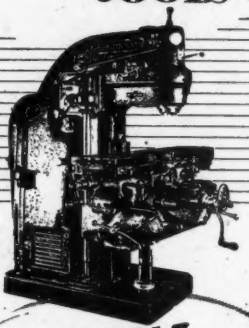
Write for Pamphlet No. F31

Flextol
POWER-DRIVEN HAND TOOLS
Regd. Trade Mark

Sole Manufacturers and Patentees:
FLEXTOL ENGINEERING COMPANY LIMITED
THE GREEN, EALING, LONDON, W.5
'Phones: EALing 6444-5-6. 'Grams: "Deminating," Ealux, London

95-35

MORE THAN
1,500 DIFFERENT TYPES
machine tools



AVAILABLE NOW!

Government Surplus machine tools available NOW at attractive prices. YOUR opportunity to get better equipment and increase production.

DISPOSAL CENTRES, *where records of all machines available may be inspected, are open to the public for enquiries from 10 a.m. to 4 p.m. Monday to Friday inclusive :—*

BIRMINGHAM
C.M.L. Buildings, Great Charles Street.

BRISTOL
8/9 Elmdale Road, Bristol 8.

CARDIFF
Imperial Buildings, Mount Stuart Square.

GLASGOW
21 Glassford Street.

LEEDS
10 Bank Street, off Boar Lane.

LONDON
Room 0088, Ground Floor, Thames House North, Millbank, S.W.1.

MANCHESTER
Britannia House, Fountain Street.

ISSUED BY THE MINISTRY OF SUPPLY

DIE STEELS *for* PLASTIC MOULDING

The ESC folder, reference PLM.1/2, contains details of steels eminently suitable for present needs.

New steels, however, are being designed to meet the special problems arising out of the rapid development in the Plastics Industry.

ENGLISH STEEL CORPORATION LIMITED

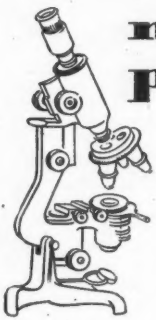
OPENSHAW MANCHESTER

A COMPLETE
BUTTON MANUFACTURERS' SERVICE..

- "ANGLON" HAND TURNING LATHES
  (Designed by EHJ and built by East Anglian Engineering Co.)
- DUST REMOVAL, HEATING & VENTILATING EQUIPMENT
- "MASTRAL" RUMBLING BARREL UNITS
  (Wood, Metal, Plastic)
- "MASTRAL" POLISHING HEADS
- MOTORISED POLISHING SPINDLES
- POLISHING JIGS
- ALL TYPES OF POLISHING MOPS
- POLISHING COMPOUNDS
- COLLETS

Our Button Manufacturers' Service is being rapidly augmented by the addition of new lines; several interesting machines will be announced shortly. Contact our Button Plant Division for full details of the E.H.J. Service.

E. H. Jones (MACHINE TOOLS) Ltd
Cables: Joltit, Phone, Telex, Guaranteed, Telex London
EDGWARE ROAD • THE HYDE • LONDON • N.W.9



mouldings to precision limits

KENT, fine-limit, moulding is opening up a new medium for the precision engineer—wherever plastic components of high accuracy are demanded, there will you find the mouldings of KENT.

KENT MOULDINGS
Footscray, Kent
Telephone: Footscray 3333

For mouldings that matter

YOU CAN'T STOP A MAN WITH A GOOD IDEA

"Hurrah! I've got a new *angle* on it—it might be made of rubber! Must speak to Lorival about it!"

RUBBER OR PLASTICS?

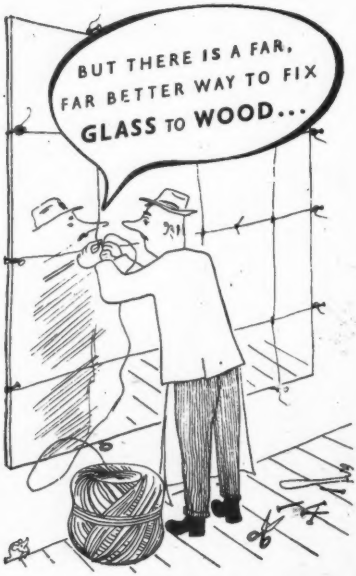
★ *While each material possesses its own characteristics, in many applications one is as suitable as the other, and in these times of scarcity it is as well to have this in mind. Firms in need of components, complete articles or packaging should seek our advice, which is based upon wide experience and specialized knowledge. We produce articles in rubber and ebonite as well as plastics, and our service includes design and manufacture.*

LORIVAL PLASTICS

U E L

UNITED EBONITE & LORIVAL LIMITED

LITTLE LEVER, NEAR BOLTON, LANCS



... use the right grade of Bostik To stick decorative glass to wooden-top tables, counters, etc., Bostik "C" Adhesive for example should be used. Bostik "C" is not a general-purpose product, it is one of a whole series — each designed to make vice-like resilient joints between particular materials. Another grade, Bostik "B" Glazing Compound, is used extensively in Aircraft, Automobile, Shipbuilding, and Electrical Industries for fixing Glass and Synthetic Transparent Panels into Glazing Frames, giving firm adhesion and a weather-resisting seal.

Not only do Bostik adhesives provide a powerful resilient joint that lasts and lasts, but, by using the appropriate grade, the joint can be made resistant to water, to petrol, or oil.

Write to-day for further interesting information.

The BOSTIK MAN who represents our technical and research departments is at your service. Call him in to advise on any problem of adhesion and sealing.

Bostik SERIES OF ADHESIVES

★ *The word "Bostik" is a registered trade mark of B.B. Chemical Co. Ltd.*

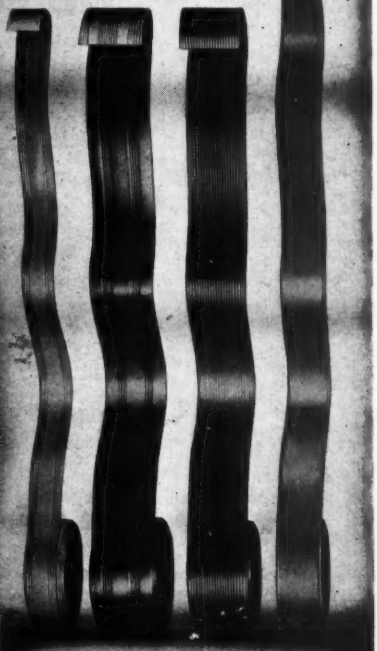
THE B.B. CHEMICAL CO. LTD., LEICESTER

Be Aware of the Dogs!

Beware of Imitations!

Durastrip

(Registered Trade Name)



Pre-eminent for Belts, Bags, Shoes, Sandals & Fancy Articles.

SOLE MANUFACTURERS

DURATUBE & WIRE LTD
FELTHAM, MIDDSX; ENGLAND

Feeding Industry

Peter Merchant Limited

Caterers to Industry

HEAD OFFICE · 5 TILNEY STREET · LONDON · W·1

Telephone : WELBECK 8311

This was the problem { *To simplify production and reduce machine operations on a high-quality radio component.*

Coil bases for Murphy radio receivers combining Bakelite Laminated, Grade P.11154, and Bakelite Moulding Material X.20/5.
T100

—solved by using BAKELITE MATERIALS

The component was a coil base which was to include a threaded insert. The problem was solved by a simple combination of two different plastics materials and two production techniques. BAKELITE Laminated, Grade P.11154, was first punched out to the required shape and the threaded boss was then moulded round it from BAKELITE Moulding Material X.20/5.

TREFOIL

BAKELITE PLASTICS

REGD. TRADE MARKS

Essential Materials for Essential Work

BAKELITE LIMITED · 18 GROSVENOR GARDENS · LONDON S.W.1

Vol. XI. No. 124 SEPTEMBER, 1947

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
Managing Director - ROLAND E. DANGERFIELD

Editor - - M. D. CURWEN, B.Sc., A.R.I.C.
Offices - Bowling Green Lane, London, E.C.1

CONTENTS

	Page
Editorial	452
Building Material from Wood Waste by High Frequency Heating	455
Cellulose Acetate Plastics, by Vivian Stannett	457
Plastic Packaging for Protection of Machinery ..	462
World's Industry Employs Plastics	465
A Modern Bookshelf ..	470
Special Problems of High Frequency Welding of Very Thin Plastic Sheets, by J. Freeman and H. P. Zade	472
Book Reviews	479
Acetylated Cotton as Filler for Phenolic Moulding Powders, by E. E. Halls ..	480
Letters	487
Plastics in Germany ..	488
Production News	489
New Productions from the Moulding Shops	492
Patent Review	494
Microscopic Examination of Plastic Materials, by J. H. Wredden	498

NOTICES

"PLASTICS" is published in London, England, on the second Wednesday of the month.
Annual subscription rate. 26/-. Shorter periods, pro rata.

All instructions, matter and passed proofs of all kinds of advertisements must reach the Head Office of "PLASTICS" by the 24th of preceding month to ensure insertion.

Head Offices:
Bowling Green Lane, London, E.C.1.
Inland Telegrams - - "Pressimus, Phone, London."
Cables - - - - "Pressimus, London."
Telephone - - *Terminus 3635 (Private Exchange).*

Midland Offices—5, Suffolk Street, Birmingham, 1.
Telephone - - - *Midland 4117-8.*
50, Hertford Street, Coventry.
Telephone - - - *Coventry 62464.*
Northern Offices—1, Brazennose Street, Manchester, 2.
Telephone - - *Blackfriars 5038-9.*
Telegrams "*Presswork, Manchester.*"
Scottish Offices—12, Renfield Street, Glasgow.
Telephone - *Glasgow Central 9036.*

EDITORIALS

Quality Goods

IN none of the exhortations by the Government, nor in the gruesome threats of "Work or Want," "Export or Die," which we apparently need to bestir ourselves, have we ever encountered an urgent and pressing appeal to maintain our pre-war excellence of quality production—standards of which we were justly proud and which were eagerly sought by buyers in New York, Shanghai, Montevideo, Madrid, Durban and Auckland. And yet is not quality far more important than quantity if we are to get new customers and to keep them?

Are we maintaining these standards? More appositely is it possible to attain them and even increase production without sufficient high-quality raw materials and without the best plant or machines which the Government seems so reluctant to give to our manufacturers first, in order to be able to build up a sound background?

Another aspect of the situation is the extraordinary change that has come over a large part of our industrial scene. Except during war-time topsyturvydom, when coachbuilders made aluminium tubes for aircraft, when restaurateurs produced shell-fuses and other precision-tooled units by the million, and when furniture builders built Mosquitos, it had never been a common thing to find one manufacturer attempting to produce objects normally made by an industry entirely different from his own. To-day we see a good many exceptions to this rule for the very good reason that new raw materials, new processes, new skills and new ideas have burst upon us. The coachbuilder makes furniture according to modern requirements, the aircraft builder makes plastic mouldings of all descriptions, and suitcases, the munition works make electric irons and refrigerators, textile weavers make shoes and floorcloths, iron workers make feather-light and fairy-like toys and ladies' trinkets, and boats are made very far from the sea. What a strange, topsy-turvy world we are living in, and how far we have gone from the old guilds.

How has quality fared since the war ended? It is true that with drastic changes that took place and in the helter-skelter to satisfy an enormous world demand and a fantastically grown world's desire to spend in addition to real needs, much rubbish, low in quality and poor in design, was thrust upon a public glad to accept anything. We have ranted sufficiently against this practice, and, luckily, it is the lesser part of our industry. The far greater part, and included in this are those new industries described above, has much craftsmanship in it, although it is no longer called craftsmanship. There is still a traditional love for good workmanship, in individual as well as mass production, and happily the shoddy is far less frequent than it was a year ago. More than ever now, with a world curtailing its purchases, is it necessary to raise the standard of our goods. More than ever now is it necessary, in our own industry, to instil into our workers the need for perfect production and perfect finishing, and for executives to insist on the use of the proper materials for the job and on proper design. Obviously, the best efforts of workers and designers are rendered appallingly difficult in the face of shortages and rising costs, the paramount need for increased care and watchfulness.

Without these high standards we shall never succeed, and it is useless increasing our output and our exports unless we keep our heads and quality at the same time. Any other way, the specious and the shoddy, means industrial and economic death.

The Best is Good Enough

IF quality is a "high-priority" matter for all goods, how much more so is it for plastics! So far as the conventional materials, metal, wood, fabrics, and so on, are concerned, the buying world knows from experience that, although there may be poor qualities and poor designs, fine qualities and fine designs are, and always will be, available.

The public is not equally sure about plastics. With a totally inadequate knowledge of what they are and blinded by a fantastic post-war publicity by the daily Press, whose ignorance seems equally profound, British and foreign buyers have already tasted the bitter fruit grown by the "spivs" of the industry, who exist and fatten by reason of their complete understanding of a single horrid truth—a drowning man will clutch at a straw.

More especially we bring up this eternal question of quality because we have received an interesting and very satisfying letter from Northern Fabrics, Ltd., of Newcastle-on-Tyne, that they, in return, have just received from Messrs. Angel and Ross, of Brazil. Here it is:—

"At the present moment the market is dull owing to the fact that the Americans have flooded the market with inferior plastic goods and the confidence of the business houses has been severely shaken.

"There is no comparison with the plastic that has been sold here and the material you produce. It has been admitted by a very big house that Northern Fabrics' material and workmanship is the best that has entered Brazil, and we take this opportunity of congratulating your good selves on your splendid standard of workmanship."

As we have already said, this is a most satisfying letter, and if we may stress the obvious, two concerns are deserving of praise: Northern Fabrics for having produced the quality goods and Messrs. Angel and Ross for selling them.

There is, however, another way of looking at the problem. We, for our part, are highly delighted that the above companies have so completely "wiped the eye" of the Americans in this industrial endeavour and are fairly certain that the matter is not merely an instance of the numerical superiority of the American "spivs" over our own variety. But before we congratulate ourselves too heartily we should reflect on the harm done by low-quality production by any nation, including ourselves.

We have an ingrained love of craftsmanship and a traditional ability to execute it; we cannot afford to let the world reach a condition in which it is unable to recognize craftsmanship, or its modern equivalent, when it sees it.

We would have the whole of the world's output of plastics and an appreciation of them on a high level. We would then better that level and benefit by it.

International Co-operation in Technology

WITH a world still largely in conflict over many economic and political aspects of life, it is pleasing to reflect in these grim days on the hopeful turn of events such as is promised by the recent formation Benelux—the Customs union between Belgium, Holland and Luxembourg, which should eliminate the tariff barriers and other difficulties which have hitherto impeded trade between these natural complementary countries.

In the scientific and even in the technological field, as we portrayed in our last issue when discussing the International Congress of Pure and Applied Chemistry, harmony and indeed co-operation is obviously far more general.

As an even more recent example of this, it is now announced that a further alliance has been made between the Kunststoffeninstitut T.N.O. Delft, the V.I.V. of Antwerp and the British Institute of Plastics Technology, London, England. The character of these three organizations is so different, compared one with another, that a common field of interest cannot at once be discerned. In Holland the Kunststoffeninstitut is a

specialist industrial foundation associated with the great teaching organization, Delft University: the V.I.V. is a professional association of engineers and industrial chemists, whilst the B.I.P.T. is a subsidiary of a publishing company, Cleaver-Hume Press Limited, responsible for the preparation and issue of specialized courses in plastics technology, conducted at present wholly as postal courses. In the preparation of such courses the B.I.P.T. has secured the help of leading plastics technicians in the U.K., and thus it follows that the experience of this country is directly and indirectly available to the joint committee.

We are now advised that in Delft on July 30 the three parties in full assembly at the Kunststoffeninstitut T.N.O., Delft, signed an agreement whereby all would contribute to the full towards the establishment of a joint teaching and examining association, specifically interested in the field of plastics technology. Our friends in Holland are well advanced in the equipment of research and training laboratories in which problems connected with the manufacture and use of plastics can be fully investigated, with the aid of the latest methods and instrumentation, in the fields of chemistry and physics. Associated technicians in Belgium have, through the centre organization, the Huishondelijke Mededelingen van de Vlaamse Ingenieursvereniging (V.I.V.) established the Kunststoffencommissie which will represent the interests of Belgian engineers and chemists working in the field of plastics and which will collate reports and data on matters of interest. Under joint control the courses prepared by the B.I.P.T. under the guidance of Dr. W. G. Wearmouth, Ph.D., B.Sc., F.Inst.P., have been translated into Dutch and will be made available throughout Holland and Belgium. At the more advanced level, the work of students in these courses will be corrected by the technicians of the Kunststoffeninstitut T.N.O. at Delft or where expedient, by the members of the Kunststoffencommissie in Belgium. Arrangements have been made for laboratory courses at Delft and for a series of lectures, demonstrations, works visit, etc., supplementing the postal courses and preparing the student for the Joint Board examination for the Diploma of Kunststoffen Technicus. It need hardly be stressed that students will in this way have the benefit of pooled knowledge from the three most highly industrialized countries in Europe. By associating together in this way the new organization should be able to put into industry a steady flow of men competent to take an effective part in the development of all branches of what may be termed the industry of synthetic materials. Furthermore, by providing a focal point for the collaboration of industrial figures, chemists, physicists, works technicians, etc., of the three countries, a widening pool of knowledge will be made available for the satisfaction of the inquiries from industry which the Kunststoffeninstitut invites and with which it is prepared to deal. In England, the B.I.P.T. have planned the establishment of similar facilities for practical training, but such plans must perforce remain in abeyance whilst present shortages of labour and materials obtain.

It is the stated hope of those who have worked towards this international agreement that it will be extended within the very near future to Scandinavia, France and Switzerland, thus building up a West European technical alliance which cannot fail, in the ultimate analysis, to conserve resources in men, materials and in the use of laboratory facilities. It will at the same time provide for such wider dissemination of real knowledge concerning synthetics.

Satisfied that the knowledge, technical resources and above all the enthusiasm necessary to administer such a scheme are available to its authors, we shall await with interest the progress reports which we are assured will be made available as the scheme comes to fruition. It seems strange that it must be left for wars to create the need for those economic and technical collaborators which cannot but result in material and moral advantages to all concerned.

Building Material from Wood Waste by High-frequency Heating

A new outlet for wood waste is anticipated from the application of H.F. heating as here described. The accompanying illustration is from an actual photograph of half-inch building board manufactured by the new process.

EXPERIMENTS carried out at the Institute of Structural Engineering, Chalmers University of Technology, in Gothenburg, Sweden, have demonstrated the applicability of dielectric high-frequency heating in bonding wood waste for the production of building material. Using wood waste in the form of shavings and sawdust, a method of producing chip board has been developed. Until now this waste, which results on a very large scale in the wood-working industries, has found few outlets, for even as fuel its combustion offers difficulties.

Methods for the production of building boards from wood waste have been developed in Germany and other countries, but hitherto such boards have not been made on a large scale. In the new Swedish method, high-frequency heating plays an important part in the economy of manufacture, and it appears possible to produce such board for insulation and other building uses at a cost which is considerably below that hitherto obtaining for material of similar character.

In bonding wood by high-frequency heating, it is desirable to concentrate the energy absorption at the "glue" line by using a material with high dielectric losses. In order to obtain this, it is expedient to work on a frequency which corresponds to maximum loss in the "glue" or bonding material, and by so placing the electrodes that maximum field strength is concentrated here. The heating of the wood mass itself, however, can never be avoided, especially in case of wood with high moisture content. This rise of temperature is generally unwanted as it seldom speeds up the process of setting, and often causes damage to the wood itself.

For the production of the new chip boards, the shavings and sawdust, as basic material, are mixed with a binder in the form of a dissolved synthetic resin glue. The chips are first sieved and the binder is squirted over them in order to get an even distribution of the resin; in this way the chips do not become sticky. They are then subjected to pressure (which will vary according to the desired specific gravity for the finished board), and while still under pressure heat is applied by aid of a high-frequency generator, whereby the setting of the binder is effected in a few seconds. This process

appears to be a notable exploitation of dielectrical heating, more especially as production of the finished board can be carried on continuously.

The specific gravity of the finished board ranges from 0.3 to 1.0. The lightweight boards (sp. gr. 0.3 to 0.5) have good heat-insulating qualities; the heavier boards (sp. gr. 0.5 to 1.0) show good mechanical qualities.

The heat insulation of the material is influenced partly by the resin content and partly by specific gravity. With boards produced particularly for insulation purposes, values from 0.04 to 0.05 are obtained.

If the manufactured board is immersed in water, the latter is taken up partly by the wood itself and partly in the air spaces. Due to the waterproof quality of the binder, the mechanical strength is lowered only to an insignificant degree, even by complete saturation with water. After drying, the material regains its former qualities. Typical medium values for coefficient of elasticity and ultimate stress (chip board of sp. gr. 0.6) are 20,000 kg./sq. cm. and 100 kg./sq. cm. respectively.

Lightweight board appears to be especially suitable for insulation purposes; mechanical strength, in that usage, may be relatively low. For insulation uses, the new chip material can be manufactured either in form of boards to be nailed to the wall structure and plastered, or as tube-like insulation. Cost of production per cubic metre is independent of the thickness of the insulation. Boards of higher specific gravity can be used as a basic acoustic material for sound absorption; in this use they can be covered with a perforated layer of plywood, veneer, cardboard, leather, oilcloth or something similar to give different degrees of sound absorption and an arbitrary frequency response.

The heavier chip boards in veneered form would find use for the manufacture of furniture, doors, shelves, etc. The very heaviest boards, with notably high mechanical strength, make an excellent material for floors. In order to give the material additional strength, a layer of plywood, or some similar veneer, is employed; the bonding of this veneer can take place simultaneously with the production of the boards.

For certain applications where high mechanical strength is of importance, a metal reinforcement can be placed in the board; this is effected simultaneously with manufacture. By bonding asbestos cement sheeting to the surface, using asphalt, finished wall elements can be produced, offering possibilities in mass production of prefabricated houses. In the United States a similar product is found in sugar-cane fibre sandwiched between asbestos cement sheeting; such boards were somewhat extensively used for prefabricated houses during the war.

The cheapness of the new Swedish product is due to the fact that the basic materials are dry, and because the raw materials (apart from the synthetic resin) are remarkably cheap.

Calculating the heating effect for the setting of one cubic metre of chip board, if the sp. gr. of the finished board is to be 0.55, the weight of wood will be 483.8 kg. per cubic metre of board, and the weight of water (at 12 per cent. moisture) 66.2 kg. per cubic metre. Assuming the specific heat of the dry wood waste to be 0.3, and that the "glue" sets at a temperature of approximately 90 degrees C., heating the wood from 20 degrees to 90 degrees will require

$$\frac{0.3 \times 483.8 \times 70}{860} = 11.8 \text{ kW},$$

while the heating of moisture in the wood requires

$$\frac{1 \times 66.2 \times 70}{860} = 5.4 \text{ kW}.$$

Total energy requirements are therefore 17.2 kW.

If about 5 kW is lost by radiation and conduction of heat, a generator of 20-25 kW output would theoretically be capable of producing one cubic metre of board per hour. Operating with an efficiency of 50 per cent., the input power to the generator would be 50 kW, a figure which has been confirmed in laboratory tests.

Cellulose Acetate Plastics

IV.—Manufacture of Cellulose Acetate (contd.)

The previous instalment of this series described the methods by which crude cotton linters or wood pulp were converted to the chemically pure cellulose, suitable for conversion to cellulose acetate. It is now proposed to describe some of the methods used for this conversion.

By Vivian Stannett

CHEMICALLY, the acetylation of cellulose follows a similar course to the conversion of any alcohol to the acetate ester. Practically, however, matters are complicated by the large size of the cellulose molecules, their high degree of association, and the necessity for avoiding any excessive breakdown of the cellulose molecule in the process. It must also be remembered that the aim of the manufacturer is not just to produce any cellulose acetate, but to produce one of good stability and purity, and with a viscosity and degree of acetylation lying within a definite range of values. The acetylating reagent itself is normally acetic anhydride. The reaction is considerably aided by the presence of a catalyst, which is usually also a dehydrating agent. A huge number of substances have been proposed and patented as catalysts, but at the present time it is doubtful whether more than two are used on a large scale.

The methods of acetylation fall naturally into two categories: Those in which the cellulose acetate is dissolved as it is formed, and remains in solution at the end of the reaction, and those in which the fibrous structure of the cellulose remains unchanged, and the acetate is formed by surface attack on the swollen fibres. The two methods are usually known as the solution and non-solution processes respectively. When the secondary or acetone soluble acetate is required, the solution method is almost exclusively employed. This is because the partial hydrolysis of the triacetate can only be brought about evenly when in solution. At the present time there is little demand for the triacetate, and, therefore, the solution method is almost always used.

Solution Process

The general scheme of the solution process of manufacture is shown in Fig. 1. As the cellulose is suspended in the acetylation liquids, and passes into solution only after conversion to the acetate, it is obvious that the physical condition of the fibres is of great importance in determining the speed and efficiency of the acetylation process. Although a high moisture content is undesirable, it has been found that too dry a cellulose is less reactive and gives a non-uniform product. The favoured percentage of moisture for cotton linters is within 2-4 per cent. for the maximum efficiency of acetylation.

In addition to the correct adjustment of moisture content, the acetylation process can be facilitated by treating the cellulose beforehand with suitable reagents. A number of methods of such pretreatment have been patented, including treatment with gaseous and liquid acetic acid, with mixtures of sulphuric and acetic acids, with formic acid, halogen acids, and many other reagents in liquid and vapour forms. The most usual method, so far as can be judged, is simply to treat the cellulose with glacial acetic acid at a slightly elevated temperature for a few hours. The pretreatment is considerably more effective if some of the acetylation catalyst is mixed with acetic acid; but, unfortunately, this treatment, especially in the case of sulphuric acid, leads to a substantial drop in the viscosity of the cellulose. Without the catalyst being present, little degradation takes place at this stage.

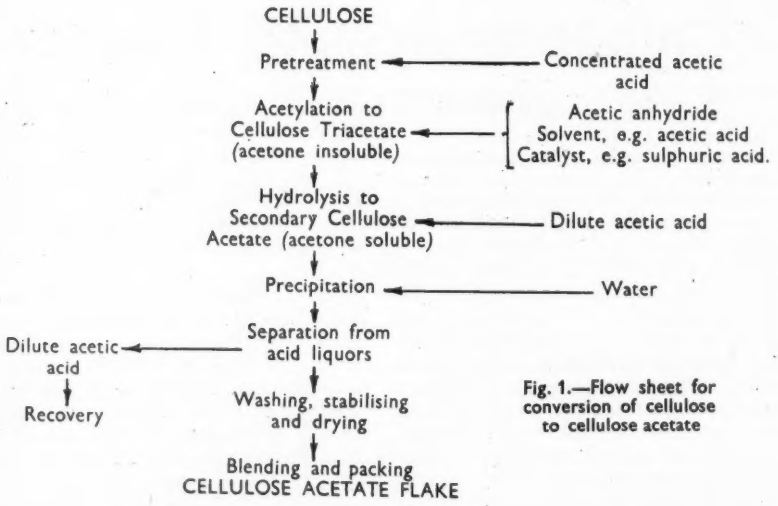


Fig. 1.—Flow sheet for conversion of cellulose to cellulose acetate

Acetylation

The vital part of the process is the acetylation proper, and it is here that careful control of conditions is necessary to produce a high-grade product. A large number of patents have been taken out on this process, and a large number of modifications are possible and doubtless practised. In general, however, the methods of acetate production which are carried out on a large scale are few in number and roughly similar in principle.

The general method is to add the dried and pretreated cellulose to the acetylation mixture contained in large jacketed vessels equipped with a stirring mechanism. Mixers of the Werner-Pfleiderer type are suitable and are often used for this process. The acetylation mixture consists of the solvent, the catalyst, and the acetylating agent itself. Normally, the latter is acetic anhydride, although certain other reagents, including acetyl chloride and ketene, have been proposed and patented.

The Catalyst

The catalyst used has also been the subject of innumerable patents; among the many catalysts suggested have been sulphuric acid, zinc chloride, perchloric acid, various sulphonic acids, and various halogen acids and compounds. The first two of these are among the most usual, and it would appear that with most of the cellulose acetate to-day sulphuric acid catalyst is being used. Zinc chloride is also effective and is used on an industrial scale; at least one of the German manufacturers used this catalyst in the large-scale production of acetate. It has the disadvantage that large amounts of the catalyst have to be used and the acetylation temperature is considerably higher than is necessary when sulphuric acid is used. Perchloric acid is said to be a particularly effective catalyst, but is reported to involve great difficulties, due to corrosion. Nevertheless, it has been used in at least one commercial process.

The superiority of sulphuric acid as the acetylation catalyst, and its consequent wide use for this purpose, has led to a considerable amount of work being done in an attempt to discover the reason for its effectiveness. As the acetylation reaction often takes place in a medium of glacial acetic acid, the strengths of various acids in this medium have been measured. It was found that the order of strengths agreed very well with their rela-

tive effectiveness as catalysts, sulphuric and perchloric acids being particularly strong compared with other acids. It is also well known that sulphuric acid is strongly adsorbed on to cellulose fibres, which also helps to account for its high activity as a catalyst. Apart from these reasons, it is now clear that the sulphuric acid takes part in the reaction, and that at one stage of the acetylation it actually combines with the cellulose to form a sulphate ester, this compound being later decomposed with the formation of acetate. It has also been established that acetic anhydride combines with sulphuric acid to form an acetyl-sulphuric acid, and the suggestion has been made that this compound is the effective acetylation agent.

Solvent Medium

The solvent medium in which the acetylation takes place is usually either acetic acid or methylene chloride, although here, again, numerous modifications have been suggested and patented from time to time. The original one is glacial acetic acid, and this is still widely used, although the use of methylene chloride offers many advantages, and is becoming increasingly popular, particularly in the United States and Germany, where large supplies of this solvent are potentially available.

The advantages claimed for this solvent over acetic acid are that the temperature control of the reaction is easier, owing to the heat of reaction being efficiently dispersed by the methylene chloride; the comparatively small quantities of acetic acid used or formed in the reaction also make its recovery much easier and more efficient. Further, the proportion of sulphuric acid catalyst used in the methylene chloride process is very much less than with the acetic acid method. Residual combined sulphate in the final product has been found to cause poor stability and heat resistance, and with methylene chloride, the chances of a very low sulphate content are considerably better. The low acid content of the reaction mixture also makes possible the production of acetates of higher viscosity, and the good solvent power of methylene chloride prevent the gelling at these viscosities which occurs with acetic acid.

Other solvents have received attention, including the use of liquid sulphur dioxide, which has a very good solvent power for cellulose acetate, and certain other advantages. For example, the solvent can be removed simply by release of pressure, and also the temperature can be controlled by this means. Among other solvents suggested have been chlorinated aromatic hydrocarbons and chloracetic acids.

Reaction Technique

The acetylating mixture can be added in many different ways, and the reaction allowed to proceed under varying conditions of time, temperature and pressure; it is certain that no two manufacturers employ exactly the same technique, even if using the same solvent and catalyst. In general, the acetylating mixture is added to the pretreated cellulose in the reaction vessel, stirring is commenced and continued until no trace of the original fibre structure remains. This point is determined by the visual examination of a test sample, sometimes with the aid of a microscope. A larger quantity of acetic anhydride is used than is theoretically necessary and usually amounts to about three parts of acetic anhydride to one part of cellulose. Temperature conditions vary with the catalyst and solvent employed. Using acetic acid as the solvent, and sulphuric acid as the catalyst, the normal procedure would be to add to the pretreated cellulose a mixture of the anhydride, acetic acid and sulphuric acid, previously mixed and cooled to around 0 degrees C. On mixing with the cellulose, the liquid is first absorbed; then the semi-solid mass gradually changes to a definitely fluid condition, followed by a gradual thickening up to a viscous syrup. During the reaction the temperature rises slowly at first to about 35 degrees C., when cooling is begun by passing cold brine through the jacket of the mixer; the reacting mixture is then kept below about 40 degrees C., until acetylation is complete. The reaction mixture is then held

at a steady temperature until the viscosity drops to the required value.

When methylene chloride is used as the main solvent, a similar procedure is adopted, although a much smaller proportion of sulphuric acid is required. This may be of the order of 5-10 per cent. on the weight of cellulose, when acetic acid is used for solution, but is only about 1 per cent. when methylene chloride is employed. The time necessary for complete acetylation varies, but is usually of the order of 5 to 8 hours for the reaction to be completed.

When zinc chloride is employed as the catalyst, slightly different conditions can be followed. The pretreatment of the cellulose follows similar lines to those previously described, and then the acetylation mixture is run in as before. In this case, the acetic acid is added with the necessary quantity of zinc chloride dissolved in it. The quantity of catalyst required is quite large, and is usually about 1-1.5 parts per 1 part of cellulose. The anhydride is then added and stirring begun. The temperature rises to about 60 degrees C., and is kept between 50 and 60 degrees C. until the reaction is complete, as judged by the disappearance of the fibres. If the viscosity of the acetate is too high, the mixture is left at this temperature until the viscosity falls to the value required.

It is worth repeating at this point that the reacted viscous mass at this stage consists essentially of a solution of cellulose triacetate. If this were precipitated by the addition of water, it would be found to be quite insoluble in acetone. In order to produce the acetone soluble secondary grade, partial hydrolysis must be carried out. This removes some of the acetyl groups from the cellulose acetate, with consequent changes in its solubility properties. The acetone soluble grade is the one normally required by the plastics and other industries at the present time, although if the chloroform soluble triacetate is required, the hydrolysis stage is completely omitted and the reacted mass is precipitated directly.

Non-solution methods have also been developed for the preparation of cellulose triacetate, and these will be described briefly later.

Hydrolysis and Precipitation

The excess acetic anhydride remaining in the reaction mixture is destroyed by the addition of water. Sufficient is added to carry out also the necessary partial hydrolysis of the cellulose triacetate. In order to avoid premature precipitation, the water is usually added as dilute acetic acid. A quantity of sulphuric acid is often added to speed up the hydrolysis, or, if zinc chloride has been used as the catalyst, hydrochloric acid is sometimes added for this purpose.

After thoroughly mixing, the syrup is transferred to the ripening vessels, which often consist of shallow copper dishes. These are transferred to constant-temperature rooms, or otherwise kept at a constant temperature, where they are left until the acetyl value has fallen to the required figure. This point is usually determined by precipitating a test sample and testing its solubility in acetone and acetone-water mixtures. The time taken for ripening varies according to the composition of the mix and the temperature, and can be from a few hours to as long as several days. In general, however, modern methods favour the accelerated ripening taking from, say, 3 to 12 hours. The temperature at which the ripening process is allowed to take place can vary from about 20 degrees C. to 60 degrees C.; too high a temperature is avoided, owing to the risk of degradation of the cellulose acetate.

When the hydrolysis has reached the desired extent, excess mineral acid can be neutralized by addition of sodium acetate. If methylene chloride has been used as the solvent, it is usually distilled off at this final stage, although partial removal earlier, at the hydrolysis stage, is sometimes carried out. The syrup is now ready for precipitation, which is usually carried out directly, although, if a super high-clarity material is required, the liquid can be diluted and filtered before precipitation.

The cellulose acetate is precipitated by the addition of a large excess of water. This requires a special technique, owing to the tendency to give gelatinous and lumpy precipitates, which are difficult to wash. The favourite procedure is that familiar to most chemists who are accustomed to handling this type of precipitation. This is to add dilute acetic acid up to the point of incipient precipitation, and then to add a large excess as rapidly as possible. By this means, an even floculent precipitate can be obtained. Other methods are undoubtedly employed, including crushing and disintegrating the precipitate in the precipitating vessel under water. The precipitate is then separated off, sometimes by centrifuging, and is repeatedly washed with water.

Combined sulphate is substantially removed during the hydrolysis, but to give increased stability the acetate is subjected to a stabilizing process at this stage of manufacture. This usually consists of boiling with very dilute sulphuric acid, although simply boiling with water or treatment with steam has been advocated by some workers on the subject. Also, chloride treatment has been recommended both to give increased stability and better colour.

After further washing the excess water is removed by centrifuging, followed by pressing. Finally, the cellulose acetate is dried at a moderate temperature under vacuum to a water content of about 1-3 per cent. To give a uniform batch of suitable size, a number of batches are blended thoroughly together and then transferred to sacks or drums.

Acetic Acid Recovery

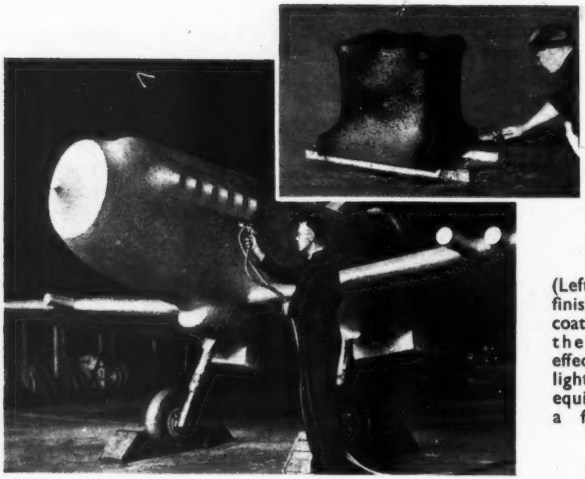
The recovery of the acetic acid from the acetylation process is a highly important economic consideration. Older methods used involved converting to sodium acetate and then recovering concentrated acetic acid from the salt by distillation with a strong mineral acid, such as sulphuric acid. This method has now been entirely superseded by solvent extraction methods. Either a solvent which is immiscible with water, but which is a solvent for acetic acid, can be used, or one which forms a constant boiling mixture with water. The latter type is usually regarded as the most satisfactory. One of the most suitable extraction solvents is considered to be ethyl acetate. After extraction of the aqueous acid liquor, the ethyl acetate-acetic acid-water mixture is then separated by means of distillation. Ethyl acetate and water form a constant boiling mixture and distil over first, followed by pure ethyl acetate. Concentrated acetic acid is drawn off from the base of the fractionating column. The ethyl acetate used can be recovered by separation from the distillate. Several alternative organic solvents and solvent mixtures can also be used.

Non-solvent Methods for Cellulose Triacetate

This type of manufacturing method is useful only for producing the acetone insoluble cellulose triacetate. Owing to the small demand for this grade of acetate, it is little used, although there are some signs that its use is increasing gradually, especially for the manufacture of electrical insulation foils and similar applications.

In general, the method of manufacture is first to treat the cellulose with glacial acetic acid for some hours at room temperature, followed by removal of excess acid by centrifuging. The swollen cellulose is then treated in the acetylation vessel with a mixture of acetic anhydride, a catalyst, and an inert liquid, which is a non-solvent for the cellulose triacetate. The catalyst used is normally sulphuric acid, although in this method perchloric acid is sometimes used, either alone or mixed with sulphuric acid. The inert non-solvent is usually toluene or benzene, although many others can be used, including carbon tetrachloride and ethers. The temperature is kept low during the acetylation by cooling of the acetylation mixture, prior to addition and also by cooling of the acetylation vessel during the reaction.

(*Continued on page* 464)



(Left) An aluminium finish for the final coating will resist the possible ill-effects of actinic light. (Above) Radar equipment receives a final bitumastic coating.

Plastic Packaging for Protection of Machinery

THE first demonstration in Europe of a new packaging method employing a plastic webbing and coating process was given at the R.A.F. Establishment at Cosford, near Wolverhampton, on July 25, in the presence of senior Service officers and many industrialists. The demonstration was sponsored by the Ministry of Supply.

The "Cocoon" process, so called, was invented and developed in the United States by Mr. Ed. J. Butler, president of the Butler Corporation Inc., of Philadelphia, Pa., and his associate, Mr. Russell Hursum. Through the enterprise of R. A. Brand and Co., Ltd., Bridge Paper Mills, Pendleton, Manchester, it is being made available in England.

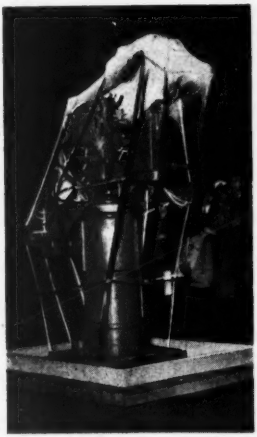
The process provides for a rather ingenious method of packaging all types of machinery and equipment to resist deterioration by corrosion. It can be used for anything from the smallest machine part to a complete locomotive, and becomes especially useful in providing protection during shipment or in storage. In the United States the process has already been employed for laying up much surplus equipment of the Navy.

The basis of "Cocoon" packaging plastic is modified film-forming resins which are carried in volatile solvents. Application by means of a standard pressure gun calls for no special skill. The first step is to provide a wooden skid for the machinery or equipment, with an underlying sheet-metal tray to afford a terminal surface. Projecting parts which are likely to perforate the plastic skin have to be padded with rag and paper. To provide a framework and give the desired contour, pressure-sensitive adhesive tape is then applied horizontally and vertically at distances not exceeding 20 ins., to form a grid or anchorage for the web-like filament which forms the foundation of subsequent coatings.

For the first application the "cocooning" solution is mixed with a webbing agent; the resulting filament, obtained by spraying, is similar in appearance to a cobweb. The technique of formation is such

(Above) The tachymetric director after receiving its first web-like film which is sprayed from a distance of 3 feet. This film actually bridges the interstices by clinging to the tapes, and so provides a foundation upon which subsequent coats of "Cocoon" packaging plastic can be sprayed.

(Below) At the commencement of the coating operation : a tachymetric director, provided with a grid of tape, all projecting parts being protected by padding.



(Right) A "Merlin" aero engine receives its second or third coating of plastic applied as a continuous translucent film. The nature of the final coating, as also the total thickness, is varied to meet different conditions of storage.

that none of this web passes through the grid; it merely bridges the interstices and adheres to the tape. The spray gun is then adjusted to the pressure needed for building up a continuous translucent film. Two coats of the solution are applied in this way, followed by a finishing coat if the package is to be in storage for a long period. Actually, the number and type of coats may vary according to requirements determined by the duration and conditions of storage. The solutions used are inflammable only while spraying is in progress; no special safety precautions are otherwise needed.

In the demonstration which we witnessed at Cosford, various pieces of Service equipment were first covered with the web filament and subsequent coatings were applied; the equipment included a tachymetric director and a Merlin aero-engine. As examples of the completed job, a radar receiving set was given a bituminous top coat. A six-pounder quick-firing gun was left with an aluminium finish, as also applied for completely covering Spitfire aircraft; the coating of aluminium paint is additionally resistant to actinic light, and is used particularly in cases where storage in the open air for a period of 10 years or more is contemplated.

As a final step before storage, any solvent vapours remaining inside the plastic skin have to be blown out through a vent which is cut for that purpose, and bags containing a dessicent (usually silica gel) are suitably placed inside the "cocoon." The openings are then patched with material which was cut out in making the vents, aided by further spraying, and finally the plastic skin is sealed in contact with the terminal sheet-metal tray. An inspection window made of "Vinylite" can be incorporated when considered desirable.

The finished package is claimed to be weather- and moisture-proof; it is also strongly resistant to mould growth and to the action of acids, alkalis, oils, grease and salt-water spray. These properties are said to be retained even if the package remains exposed to outside weather for 10 years. The tensile strength of the plastic skin is 1,750 to 2,000 lb./sq. in. Removal is a very simple matter; the coating is merely cut and then stripped off by aid of a knife.

CELLULOSE ACETATE PLASTICS

(Continued from page 461)

In this method, the fibrous nature of the cellulose remains virtually unchanged, and the end of the reaction is determined by withdrawing a sample and testing its solubility in a chloroform or methylene chloride-alcohol mixture, usually in a 9:1 ratio respectively. The viscosity of the product can be largely controlled by the temperature of the acetylation reaction and checked by the testing of samples. Excess of acetylating mixture is then removed by centrifuging, and the fibrous product is well washed with benzene, or similar solvents, to free it from acetic acid. Finally, the triacetate is well washed with water and dried to free from any combined sulphate; the product can be boiled with stabilizing agents, as in the solution process.

Using the non-solvent process, a product containing nearly the theoretical amount of combined acetic acid for cellulose triacetate can be obtained in a fibrous form.

REFERENCES

(1) *German Plastics Practise. DeBell, Goggin and Gloor*, 1946. (2) *O.P.B. Report* 377. (3) *O.P.B. Report* 222. (4) *Munson, I.E.C.*, 1930, **22**, 467. (5) *Ott, High Polymers, Vol. V. Interscience*, 1943. (6) *Yarsley, Synthetic Resins and Allied Plastics. Morrel*, 1943. (7) *Adamson, I.P.I. Monograph No. 7*, 1946. (8) *Lipscomb, Cellulose Acetate. Benn*, 1933. (9) *Doree, Cellulose Chemistry*, 1947. (10) *Colloid and Amorphous Materials. Macmillan*, 1943. (11) *C.I.O.S. Reports XIX-5, XXIV-3, XXV-19, XXVI-75, XXVII-16.* (12) *B.I.O.S. Report* 1,090, *Item* 22, *and Report* 185, *Item* 22. (13) *F.I.A.T. Reports* 490, 713, 450, 486.

World's Industry Employs Plastics

GENERAL ENGINEERING

Bearing bushes.—H. Frank reports on investigations for the determination of practical running clearances of laminated textile bearing bushes. The results of this work were particularly used for drafting German standard DIN/16/902, which deals with laminated bushes for bearings with oscillating movements at high specific pressures and high shock loads. ("Kunststoffe," 1947/**37**/46.)

Impregnation of porous castings with resin under vacuum pressure is described in "Machinist," 1947/**91**/448. The tank described is claimed to be faster and more economical than other methods.

Rapid inspection of plastic sheets is facilitated by multi-point inspection fixture. Six electric gauges are rigidly fixed to a horizontal bar, opposite to six fixed anvils. For the initial adjustment, master gauges are used. (Sigma sheet thickness inspection fixture, E. H. Jones (Machine Tools), Ltd., London.)

Laminates.—C. Brinkmann discusses the question as to whether laminated paper or laminated textile materials show ageing phenomena. Tests have been carried out to find a relationship between age and distinct physical and technical properties. Natural ageing does not influence these properties. ("Technik," 1946/**1**/141.)

Cause for cracks, and the lower mechanical strength of injection-moulded parts, is explained by W. Weigel, utilizing micro-sections which clearly show the path of flow of material in the mould. ("Kunststoffe," 1947/**37**/11.)

Electrical evaluation.—W. Krassowsky reviews important regulations of the Verein Deutscher Elektrotechniker (German Association of Electricians), which deal with the testing and the evaluation of plastics and their use in electrical engineering. ("Kunststoffe," 1947/**37**/33.)

Bonding technique.—K. Thinius deals critically with the problem of bonding between layers of different polymers. He has found that different film-producing plastics can be bonded without the use of a solvent for both materials, a condition hitherto considered to be indispensable. ("Kunststoffe," 1947/**37**/36.)

CHEMICAL

Vinyl ethers are latest additions to the vinyl family; six of these ethers are already on the market. ("Scientific American," 1947/June/261.) Carbide and carbon chemicals are now offering isopropyl and 2-ethyl hexyl vinyl ethers, as well as the ethyl product, presumably manufactured by different methods.

Polyvinyl chloride.—J. W. Breitenbach and W. Thury (Chemical Laboratory of the University, Vienna) have made investigations upon the polymerization of liquid vinyl chloride ("Experientia," 1947/**3**/281). Pure liquid vinyl chloride cannot be made to polymerize by heating it up to 110 degrees C. In the presence of benzoyl-peroxide, however, it polymerizes and large molecules are formed by rapid reactions already at low temperatures, say, 20 to 50 degrees C.

Urea and sulfamid, as basic materials for new plastics, are reported upon by A. M. Paquin, who describes numerous new reactions of urethan with formaldehyde, and urea and sulfamid metal combinations with amino bases. ("Kunststoffe," 1947/**37**/3.)

MISCELLANEOUS

Artificial leather.—K. Stoeckert reviews plastics and auxiliary materials in the artificial leather industry. The first plastic in this industry was nitro-cellulose, but in recent years other materials have been used, such as polyvinyl chloride, polyamides, and dispersed plastics. ("Kunststoffe," 1947/**37**/5.)

Relative protection afforded by plastics used as coating or moulding material for electrical purposes can be predicted by permeability or diffusion data. Results of such experiments have been recorded by G. Deeg; in particular, the influence of plasticizers has been investigated. ("Bell Laboratories Record," 1947/June/227.)

Building materials.—J. Hausen reports on investigations to use thermoplastics and plastics of sponge-like structure as independent building materials for houses ("Kunststoffe, 1947/**37**/9). Mass tests seem to be necessary to show whether these materials will be useful for this purpose and that the design employed will be correct.

Household crockery.—H. Turnwald shows that it is possible to develop plastic "crockery" of such a shape that one part can almost be placed inside the other, thus reducing shipping and storing space. In the case of a teacup, the stapling height of 10 cups, each $2\frac{5}{16}$ ins. in height, can be reduced to 20 per cent. of the stapling height of equivalent porcelain cups. The plastic cups also show a weight reduction of 88 per cent. ("Kunststoffe," 1947/**37**/39.)

Natural-history specimens, such as flowers and butterflies, can be preserved in a cold-pouring transparent plastic, such as "Castolite" or "Kemnitz." ("Science Illustrated," 1947/July/106.)

Moulding capacity.—H. Fleischauer states that the capacity in plastic moulding shops is much lower than in other plants, partly owing to the fact that press operators do not obtain a planned training. Through the introduction of a thorough training scheme, a considerable increase in performance and capacity has been obtained. ("Kunststoffe," 1947/**37**/30.)

Plastic foils.—For measuring the permeability of water vapour through plastic foils, R. Vieweg and Th. Gast have developed a recording electrical microbalance. ("Kunststoffe," 1944/**34**/117; "Technik," 1947/**2**/238.)

Cost of plastic moulds is likely to be reduced by Guy P. Harvey and Son Corporation, who have developed a method of casting stainless-steel cavities and inserts. The pattern-making principles for this method are outlined by H. L. Flynn ("Machinist," 1947/**91**/441). The cavities are cast to size and the surfaces obtain a satin-grey finish by honing and polishing.

SOURCES OF REFERENCE

We wish to remind readers that the sources of reference from which these pages are compiled are not, in general, retained in this office. We cannot, therefore, undertake to supply such originals. Nevertheless, most of the foreign journals referred to are available in the Patent Office Library (Southampton Buildings, Chancery Lane, W.C.2) and in the Science Library (South Kensington). Photo-duplicated copies of articles may be obtained from the Photostat Dept. of the Patent Office.

Essay in the Picturesque

Both objects displayed above were first seen publicly at the 1947 B.I.F. on the stand of British Celanese, Ltd., from whose sheet cellulose acetate, "Celastoid," they were fabricated.

The clock case is admirably designed, the colourful "living" seascape being especially intriguing; the mechanism not only rocks the "brigantine" but also continuously changes the lighting, giving dawn to starlight effect.

The clock is manufactured by Vitascope Industries, Ltd., of Ramsey, Isle of Man. The lampshade, made by Daveen Manufacturing Co., Ltd., of 41, Howland Street, London, W.1, is formed from two annularly spaced sheets of acetate holding between them a lovely ostrich feather dyed a delicate brown.

Examples of design by Mr. E. J. Doudney using "Perspex" as a basic material for carving. This trend in design for decorative purposes was to be seen on the stand of Halex, Ltd., at the B.I.F., 1947. The illustration in the top right-hand corner shows a shop display stand for hat and gloves.

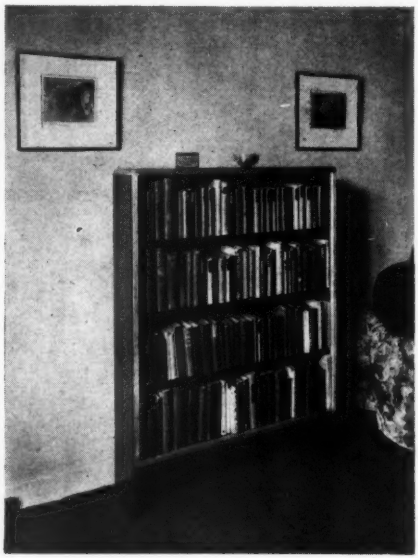
BOY'S HEAD

Cast in Catalin resin, this head was modelled by E. J. Doudney, A.R.B.S., M.S.I.A. The artist has sent us the illustration in support of Mr. Friese-Greene's arguments recently set out in these pages under the title of "Plastics as Living Materials."

K

A MODERN BOOKSHELF

FOLLOWING our recent publication of Mr. Friese-Greene's paper "Plastics as Living Materials," which he had delivered before The Institute of the Plastics Industry, we visited his factory where the workers are true craftsmen and where great wrought iron "manorial" gates "for export only" were being hammered into shape almost side by side with the delicate carving of *objets de virtu* from transparent plastics. It seemed a strange juxtaposition, yet we know now that this is not strange at all.



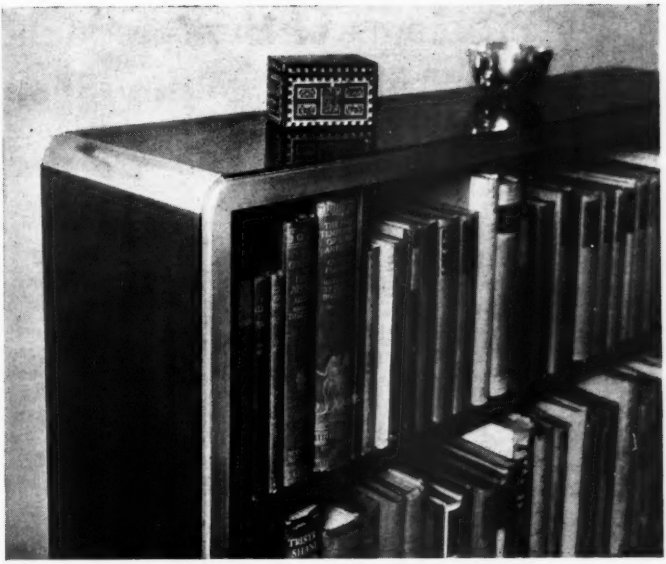
The real object of our visit was to obtain Mr. Friese - Greene's views on what a bookshelf made from plastics should look like. Our own ideas were that it should be completely free of ornamentation, simple and smooth in line, and extremely strong. As for "texture" or colour, it should be somewhat sombre yet also full of light; we couldn't quite explain what we meant by this apparently contradictory description. Mr. Friese-Greene thought he could get it by utilizing both plastics and metals, a combination he is never averse to using if the desired characteristics can thereby be attained.

The result is shown here—we leave our readers to judge from ordinary black-and-white photographs how successful it has been.

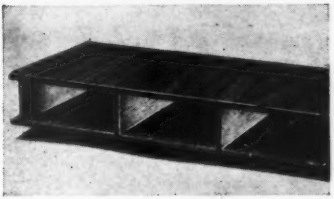
The main material employed is "Holoplast," the plastic structure we have often described as being the only one we know based on that sound engineering principle, the I-girder system uniting ⅛-in. flat resin-impregnated sheets. The final form as it issues from the press is illustrated; it is a hollow, rigid structure 8 ft. by 12 ft., the two sheets virtually one with the "girders," with an overall thickness of 1 in. The material can be readily sawn, threaded and otherwise machined.

The dimensions of the present bookshelf are 40 ins. wide by 54 ins. total height. A warm dark brown "Holoplast" has been used. As will be seen from the photograph, the two top corners are in the form of "quadrants" of extruded aluminium, and the curve gives a pleasingly smooth line. Details of construction are given in the accompanying drawings. The facing of the bookshelf is also carried out in extruded aluminium, the smooth exterior adding a pleasing lustre to the whole, while a double-channelled section allows for the provision of two sliding doors which may be either of plate glass or of "Perspex."

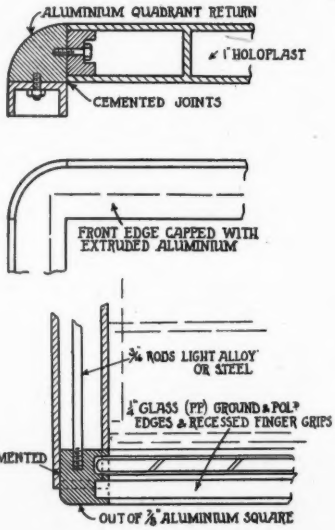
The whole of the main structure—top, two sides and four shelves—is of "Holoplast," which, as we have already indicated, was chosen for its strength, for books are extremely heavy. It is also common knowledge that even the best woods are not sufficiently rigid and all



Close-up view of top corner of bookshelf, showing quadrant joining front edge capping, both of extruded aluminium.



The "Holoplast" structure is a sound engineering principle.


ALUMINIUM QUADRANT RETURN
1" HOLOPLAST
CEMENTED JOINTS
FRONT EDGE CAPPED WITH EXTRUDED ALUMINIUM
¾" RODS LIGHT ALLOY OR STEEL
¼" GLASS (PP) GROUND & POL'D EDGES & RECESSED FINGER GRIPS
CEMENTED
OUT OF ⅜" ALUMINIUM SQUARE

sag to a lesser or greater extent in proportion to the length of the shelf. In the present instance, where the shelves are 40 ins., and therefore wider than usual, there has been no measurable sagging whatsoever.

If we may add an interesting engineering note, it is that at no point in the structure is there any screw visible, and that while the metal facing must have been constructed from four extruded lengths, yet no weld is visible at any one of the four corners, even when examined with a high-powered magnifying glass. The method of joining the whole structure is made clear in the drawings.

Special Problems of High-frequency Welding of Very Thin Plastic Sheets

By J. Freeman and H. P. Zade*

ALTHOUGH the welding of flexible plastic sheet materials on the whole has become an established technique in manufacture, and is used to a very large extent in various trades, certain difficulties have been encountered when trying to weld very thin materials. For the purpose of this paper the term "very thin" is intended to cover thicknesses below 0.005 in. For a number of reasons, manufacturers of plastic sheeting endeavour to reduce thickness. As the calendering technique has now been improved and the production of such sheets becomes a practical proposition, it is of interest to analyse the particular problems involved in the high-frequency welding of very thin thermoplastic sheet materials.

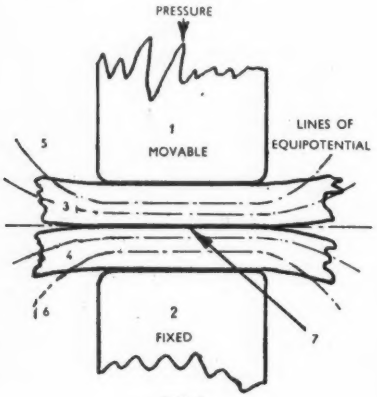


FIG. 1

In order to understand the mechanism of heating by radio frequency (welding can be considered as a special case of dielectric heating) it will be necessary to idealize the problem to some extent. Fig. 1 shows diagrammatically the set-up for a welding job in its simplest shape. In this diagram (1) and (2) are the opposing metal electrodes (between which the weld is to be made) duly connected to the source of R.F. current; (3) and (4) are the sheets of plastic material to be welded. It is customary to keep one of the electrodes stationary, in most cases the bottom electrode (2), and to exert pressure on the top electrode (1).

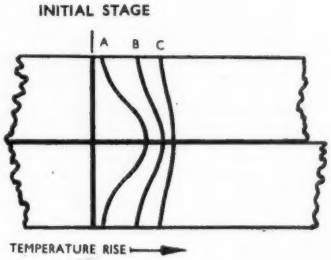


FIG. 2

If we neglect for a moment the effect of the edges, the electric field distribution between the electrodes is homogeneous, characterized by equipotential lines which are parallel to one another; the heating effect is, therefore, homogeneous right through the mass of material in all its parts. Assuming now that the metal electrodes are of infinite bulk, it is obvious that the surface of sheets (3) and (4) in contact with electrodes (1) and (2) will not obtain the same temperature as the interface (7) between the sheets, owing to heat flow from surfaces (5) and (6) to the electrodes. Further, it will be noted that given sufficient time, a certain amount of heat flow will take place from the interface of

* Industrial Laboratory, Rediffusion, Ltd.

$$u = \frac{4Hb^2}{\pi^3 K} \times \sum_{n=1}^{\infty} \left\{ \frac{1 - e^{-(2n-1)^2 \pi^2 \alpha^2 t / b^2}}{(2n-1)^3} \right\} \sin(2n-1)\frac{\pi x}{b} \quad (1)$$

Where u = temperature at selected plane (°C.)
H = energy input to wood (gm.cal./sec./cc.)
b = thickness of block (cm.)
k = thermal conductivity (cal./sq.cm./sec./°C./cm.)
t = heating time (secs.)
ρ = density (gm./cc.)
c = specific heat (cal./gm. °C)
x = distance of plane from one electrode (cm.)
and $\alpha^2 = \frac{k}{c\rho}$

$$u = \frac{4Hb^2}{\pi^3 K} \times \sum_{n=1}^{\infty} (-1)^{n-1} \left\{ \frac{1 - e^{-(2n-1)^2 \pi^2 \alpha^2 t / b^2}}{(2n-1)^3} \right\} \quad (2)$$

the sheets to be welded through the material to both electrodes.

Fig. 2 shows diagrammatically the temperature distribution likely to occur in the plastic sheets at various time intervals. Curve A represents the idealized temperature gradient very shortly after switching on; curves B and C show the variation in temperature distribution after increasing intervals of time. It will be realized that the thermal conductivity of the material to be welded determines the rate of heat flow under these conditions, and that the thickness of the sheets to be welded is important from the point of view of obtaining sufficient heat energy at the interface for reaching the softening temperature. If, for instance, heat input is controlled in such a way that all the energy supplied in the form of radio frequency current and converted into heat is flowing away rapidly from the interface, the temperature at the interface will never reach that at which softening and subsequent welding can take place.

Practical experience has shown that with decreasing sheet thickness the specific power in watts per square inch required to obtain successful welds increases very rapidly. Obviously it is uneconomical to work under such conditions. However, two separate methods of overcoming the excessive heat flow present themselves:—

(a) Application of thermal insulation between electrodes and power supply.

(b) Preheating of electrodes to reduce temperature gradient between surface of plastic and electrode.

From the practical point of view, the first-named method seems to offer more advantages, since the fact that the outside surface of a weld is kept comparatively cool is considered to be an advantage in so far as it prevents sticking of the plastic sheet to the electrodes. However, both methods are of great interest, and we, therefore, thought it worth while to make an investigation into these problems from the mathematical point of view.

G. H. Brown in a paper on heat conduction problems in wood gluing (*Proc. I.R.E.*, October, 1943, 537-548) has developed some equations giving the temperature at different planes of a wood block when heated with radio frequency power. These take account of the loss of heat to the electrodes due to conduction through the wood from the centre of the block. The final expression for temperature at any plane is given by equation (1).

This equation is applicable to any dielectric material heated in block form by this method, and if small thicknesses of material are to be heated, radiation and convection losses at the ends of the electrodes will be small and may be neglected. Hence equation (1) may be used to give a complete estimate of the power requirements.

If we wish to attain a certain temperature at the centre of the block, we can make the substitution $x = b/2$ in equation (1), giving equation (2).

When investigating the power requirements for one particular material, of

$$P = \frac{4{\cdot}18\,u\pi^3K}{4b^2} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2t/b^2}}{(2n-1)^3}\right\}} \quad (3)$$

$$P = \frac{4{\cdot}18\times6{\cdot}45\,u\pi^3K}{4b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2t/b^2}}{(2n-1)^3}\right\}} \quad (3a)$$

which we may require to heat different thicknesses, it is useful to plot power per square inch of surface area against thickness for different times. Hence we may rewrite equation (2) in the form of (3), where P = 4.18H = power in watts/cc., or as (3a), where P = power in watts/sq. in.

We may now use this equation to find the power requirements for welding thermoplastic materials. The block now consists of two sheets of material, and the temperature (u) at the centre of the block will be the final temperature required at the interface.

Equation (3a) has been plotted in two ways. First in Fig. 3 power is plotted against thickness, with time as a parameter, taking values of b from 0.0025 to 0.10 in., and times of 1/4 to 10 seconds. The limiting curve of $t \to \infty$ is also shown (it should be noted that thickness of material is thickness of two sheets.)

The constants used (for polyvinyl chloride) were: Specific heat (c), 0.4; density (ρ), 1.6; thermal conductivity (k), 4×10^{-4}. The welding temperature was taken to be 120 degrees C.

The power required, if there is no loss to the electrodes, is then given by the normal thermal relationship:—

$$P = \frac{4.18\rho cu}{t} \text{ watts/cc.} \quad . \quad . \quad . \quad . \quad (4)$$

These are the power requirements for fully thermally insulated electrodes.

This equation has been reduced to units of watts per square inch of surface area, and for t = 1 second and t = 2 seconds is shown as a dotted line on the graph. We thus see that with increasing thickness the original power curve approaches and finally coincides with the curve of power against thickness with no loss to the electrodes.

The region in which the power input is a minimum for a given

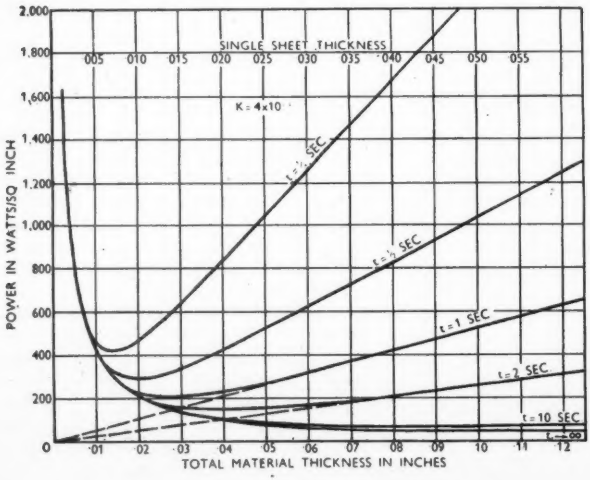


Fig. 3.—Power required to weld p.v.c. (curves plotted from equation 3a).

$$P = \frac{4{\cdot}18 \times 6{\cdot}45\, u\, \pi^3 K}{4b\,(1 - e^{-\pi^2\alpha^2 t/b^2})} \qquad (5)$$

$$\frac{dP}{db} = \frac{4{\cdot}18 \times 6{\cdot}45\, u\, \pi^3 K}{4} \times \frac{\frac{1}{b}\left(-\frac{2\pi^2\alpha^2 t}{b^3} e^{-\pi^2\alpha^2 t/b^2}\right) + \frac{1}{b^2}\left(1 - e^{-\pi^2\alpha^2 t/b^2}\right)}{b^2\left(1 - e^{-\pi^2\alpha^2 t/b^2}\right)^2} \qquad (6)$$

$$\frac{1}{b} \times \frac{2\pi^2\alpha^2 t}{b^3} e^{-\pi^2\alpha^2 t/b^2} = \frac{1}{b^2}\left(1 - e^{-\pi^2\alpha^2 t/b^2}\right)$$

$$\frac{2\pi^2\alpha^2 t}{b^2} e^{-\pi^2\alpha^2 t/b^2} = 1 - e^{-\pi^2\alpha^2 t/b^2}$$

$$e^{-\pi^2\alpha^2 t/b^2} = \frac{2\pi^2\alpha^2 t}{b^2} + 1 \qquad (7)$$

time is of some interest, and we will investigate this further. In this region we can assume (for the constants we are using) that the curve is fully defined by the equation (5), since all smaller terms can be neglected.

Then, keeping t constant and differentiating with respect to b, we have equation (6); for $\frac{dP}{db} = 0$ we obtain equation (7). This gives

$$\pi^2 a^2 t/b^2 = 1.259$$

$$t/b^2 = \frac{1.259}{\pi^2 a^2} \quad . \quad . \quad . \quad (8)$$

Hence for any value of t we can find the value of b which requires the minimum power; also, we can find the value of P in terms of b at these points.

Substituting $t/b^2 = \frac{1.259}{\pi^2 a^2}$ in equation (5) we get equation (9), where b is in cm., or Pb = 5.52, where b is in inches. Hence the minimum points of the curves lie on a rectangular hyperbola.

The second way in which equation (3a) was plotted was using b as a parameter, and thus showing power against time for various thicknesses (Fig. 4).

One further point which was investigated was the influence of k (thermal conductivity) on the power requirements.

$$P = \frac{4{\cdot}18 \times 6{\cdot}45\, u\, \pi^3 K}{4b\,(1 - e^{-1{\cdot}259})} \qquad (9)$$

Accordingly, comparison was made for power requirements for two materials of the same specific heats and densities, but with different values of k. The values used were $k = 4 \times 10^{-4}$ for polyvinyl chloride, and $k = 3 \times 10^{-4}$ for polyvinylidene chloride. The two sets of curves are shown in Fig. 5 for times of $\frac{1}{2}$ and 2 seconds.

The next part of the present paper deals with conditions obtained when preheating the electrodes to temperatures between room temperature and the softening point of the plastic. In order to simplify the mathematics it is necessary to make a few assumptions.

We will suppose that the electrodes are heated to a temperature one-third of the final temperature u and kept at this level throughout the heating cycle. We shall make the assumption that there is no flow of heat from the electrodes to the material; during the short times with which we are concerned, this approximation does not materially affect the calculated results.

The heating cycle is now divided into two parts. First, the material is raised

$$P = \frac{4{\cdot}18 \times 6{\cdot}45(2u/3)\pi^3 K}{4b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2 t_2/b^2}}{(2n-1)^3}\right\}} \quad (11)$$

$$\frac{4{\cdot}18 \times 6{\cdot}45(2u/3)\rho cb}{t-t_2} = \frac{4{\cdot}18 \times 6{\cdot}45(u/3)\pi^3 K}{4b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2 t_2/b^2}}{(2n-1)^3}\right\}}$$

$$\frac{\rho cb}{t-t_2} = \frac{\pi^3 K}{2b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2 t_2/b^2}}{(2n-1)^3}\right\}} \quad (14)$$

to the temperature of the electrodes—u/3—with no heat flow to or from the electrodes. In this case the normal thermal relationship applies and we have

$$P = \frac{4{\cdot}18 \times 6{\cdot}45\,(u/3)\,\rho cb}{t_1} \text{ watts/sq. inch} \quad . \quad (10)$$

where t_1 is the time taken.

Secondly, the material is raised from temperature u/3 to temperature u with loss of heat to the electrodes as before. Then, if t_2 is the time taken for this part of the cycle we obtain equation (11), and if t is the total time (as before) we have

$$t_1 + t_2 = t$$

$$t_1 = t - t_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

and

$$P = \frac{4{\cdot}18 \times 6{\cdot}45\,(u/3)\,\rho cb}{t - t_2} \quad . \quad . \quad (13)$$

Finally, from (13) and (11) we reach equation (14), which for any given value of t gives the relationship between t_2 and b, while equation (13) gives the power requirements.

Suppose now that the electrodes are

$$\frac{4{\cdot}18 \times 6{\cdot}45\,(u/3)\,\rho cb}{t-t_2} = \frac{4{\cdot}18 \times 6{\cdot}45\,(2u/3)\,\pi^3 K}{4b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2 t_2/b^2}}{(2n-1)^3}\right\}}$$

$$\frac{2\rho cb}{t-t_2} = \frac{\pi^3 K}{4b} \times \frac{1}{\sum_{n=1}^{\infty}(-1)^{n-1}\left\{\frac{1-e^{-(2n-1)^2\pi^2\alpha^2 t_2/b^2}}{(2n-1)^3}\right\}} \quad (15)$$

preheated to a temperature 2u/3. Then equation (14) becomes (15), and power input is given by:—

$$P = \frac{4.18 \times 6.45\ (2u/3)\ \rho cb}{t - t_2} \text{ watts/sq. inch} \quad . \quad (16)$$

Fig. 6 shows power requirements against thickness for a total heating time of one second in the four cases dealt with above, i.e., power input is shown for heating with cold electrodes, with electrodes heated to u/3 (= 40 degrees C.) and 2u/3 (= 80 degrees C.), and lastly, the ideal state with no loss of heat from the material. The ideal state is obtained either by thermally insulating the electrodes or by preheating them to welding temperature.

Conclusions

An attempt has been made to explain the theoretical reasons why very thin plastic sheet materials require considerably higher power densities than thicker ones. Referring to the individual curves, it will be noted that in Fig. 3 there is a minimum power density for any given welding time, the minimum shifting towards greater thicknesses with increasing times. The actual welding conditions will be made much clearer in Fig. 4, where curves are plotted to show the specific power against logarithm of time. It will be seen from this family of curves that for thicknesses of 0.010 in. and higher (single sheet), power requirements in the region of 3-10 seconds welding time do not vary very much. The curves for 0.005 in. and 0.0025 in., however, show that, independent of welding time, power requirements are almost constant and very much higher (up to four times those for 0.010 in. thickness).

In Fig. 5 the influence on power requirements of the thermal conductivity of the material to be welded is shown for two distinct welding times, i.e., ½ second and 2 seconds. The interesting fact will be noted that in the case of the ½-second weld, power requirements up to 0.0125 in. are very much lower for the material with lower thermal conductivity, while above this thickness no appreciable difference can be found. In the case of the 2-second welding time, the same applies for thicknesses up to 0.025 in., while above this thickness no appreciable difference will be found.

In the second part of this paper an attempt has been made to describe the power requirements with preheated electrodes, selecting preheating temperatures of 40 degrees C. and 80 degrees C. respectively, power requirements being plotted against thickness of

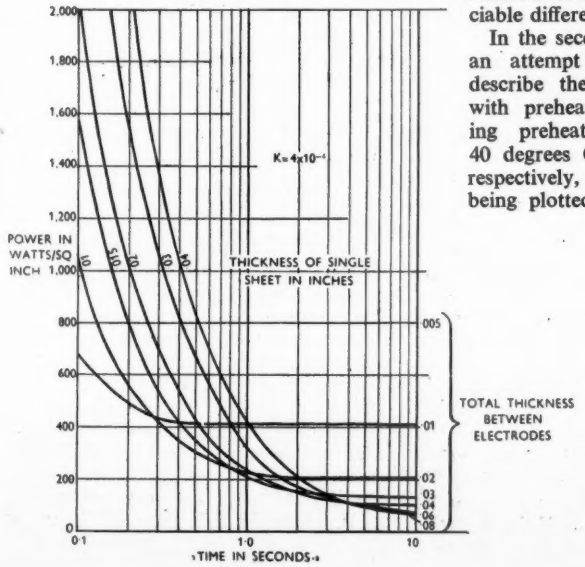


Fig. 4.—Power required to weld P.V.C.

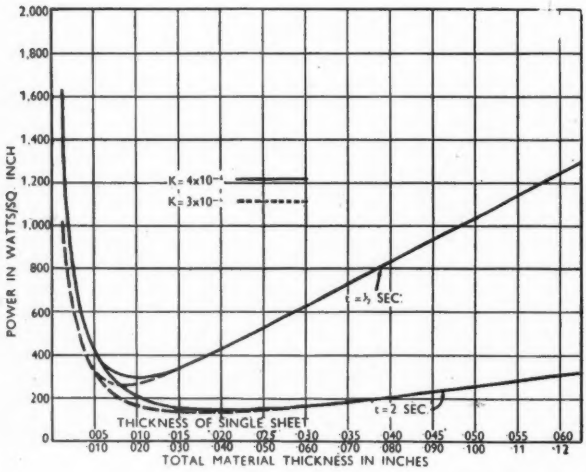
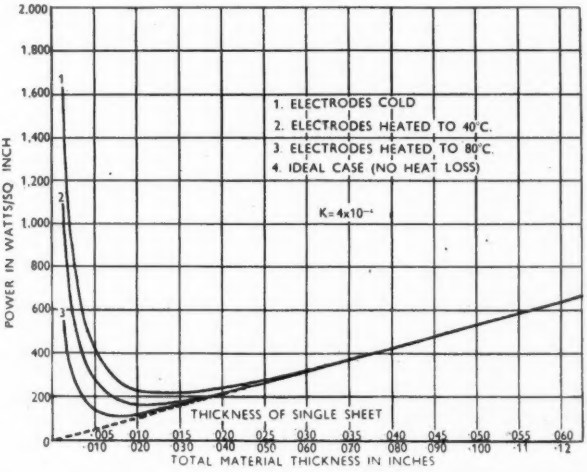


Fig. 5 (left).—Power required to weld materials of different thermal conductivities.

Fig. 6 (below).—Power required to heat material in 1 sec. under various conditions.


1. ELECTRODES COLD
2. ELECTRODES HEATED TO 40°C.
3. ELECTRODES HEATED TO 80°C.
4. IDEAL CASE (NO HEAT LOSS)
K= 4x10⁻⁴
POWER IN WATTS/SQ INCH
THICKNESS OF SINGLE SHEET
TOTAL MATERIAL THICKNESS IN INCHES

material as seen in Fig. 6. Here separate curves are given for the following conditions:

Curve 1.—Electrodes without preheating.

Curve 2.—Electrodes preheated to 40 degrees C.

Curve 3.—Electrodes preheated to 80 degrees C

Curve 4.—Ideal condition (no loss of heat).

It will be noted that the power requirements for material thicknesses below 0.020 in. to 0.030 in. are considerably reduced by the preheating method. In the ideal case—that is to say, if the electrode surfaces were at welding temperature—a linear curve relating specific power to thickness would be obtained.

From the practical point of view, however, this would not be advisable, because of the tendency of the heated material to stick to the electrodes. In effect, the curve 4 is identical with that obtained in the case of using ordinary heat-sealing tools, where heat is supplied from the

(Continued on page 505)

BOOK REVIEWS

"Welding of Plastics." By G. Haim and H. P. Zade. pp. 206. Crosby Lockwood and Son, Ltd. 21s. net.

The welding of plastic materials, so far as its industrial history is concerned, is only about nine or ten years old, and like the production of many thermoplastics and their widespread use in industry, reached widest application in Germany as a result of the four years plan and of the determination to replace lead, copper and the other metals which the Germans did not possess. To-day the welding of thermoplastics is on the eve of rapid expansion.

So far as this country is concerned, there is no doubt that Mr. Haim and Dr. Zade have been responsible for most of the scientific and industrial development of the welding of plastics and we can be very thankful to these two scientists for doing so much to introduce what is virtually a new technique and indeed a new specialized industry.

The present book is probably the first which deals solely with welding; moreover, it is so comprehensive in both scientific and industrial aspects that it is likely to become the standard publication on the subject.

The opening chapters describe in detail those plastics which are amenable to welding, together with their physical and electrical properties upon which their general use and their manipulation by the various welding processes depend. The range includes all the cellulose plastics, nylon, rubber hydrochloride, polyisobutylene, the acrylic resins, polystyrene, polythene, p.v.c., polyvinylidene chloride and Thiokol.

Chapter 4 deals with hot gas welding and, what might be described as a companion method, hot tool welding is dealt with in Chapter 5. Both these methods are attractive because of their relative simplicity and flexibility, and obviously they are of special importance to the fabrication of chemical plant which is built to individual requirements. The apparatus available for both processes is adequately dealt with.

Welding by high frequency, a subject which has been dealt with more frequently than any other method of welding because of its application to series or mass production, is dealt with theoretically in Chapter 6. The description of the many machines on the market, together with cost details and maintenance is given in Chapter 7. A special chapter is also devoted to seam welding, since this method covers such a wide field.

The concluding chapters deal with a very complete description of the application of welding plastics, and the methods of training of welders. Throughout the book each chapter is adequately provided with very complete lists of references for those who wish to consult orginal work on the subject.

Altogether, this is a most welcome volume, completely satisfying in both the theoretical and practical aspects of the problems involved.

"The Metallization of Plastics." By J. R. I. Hepburn. pp. 71. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. 6s. net.

This is one of a series of monographs intended to provide authoritative information upon particular aspects of plastics. The subject covered by the present title is one which has attracted a good deal of interest in recent years, but upon which published information has been somewhat meagre. Experience has very definitely indicated that certain physical properties which are characteristic of the metals are sometimes desirable in plastic products for special applications. These properties fall broadly into five groups, viz., mechanical, optical, electrical, thermal and chemical. Relatively thin coatings of metal from the mechanical viewpoint tend to lengthen the working life of plastic parts which are especially subject to abrasion, i.e., motorcar fittings and similar parts hitherto fabricated in metal, but which may now be readily moulded in plastic and subsequently metallized. On the electrical side there have been remarkable developments of moulded plastics in the radio industry, which have led to a demand for electrical conductivity in components; this demand has been met by metallizing the parts concerned. To give another instance, metallized panels of laminated plastic board have found usefulness as wall panels which have the property of avoiding localized overheating.

The author does not go very deeply into applications of the metallized plastics, but concerns himself mainly with the process by which metallization may be achieved. Separate chapters are devoted to the deposition of metallic coatings from solution, to metal spraying, and to cathode spluttering and vacuum evaporation, each chapter having a short bibliography added as a guide for deeper reading. The final chapter deals with the characteristics and testing of the metallized deposits.

Acetylated Cotton as Filler for Phenolic Moulding Powders

By E. E. Halls

Considered from a broad point of view, the phenolic resin moulding powders are generally recognized as capable of producing the most stable of mouldings for service under a variety of fluctuating conditions; this is so, in comparison with products from other powders such as the aminos, acetates, polystyrenes, etc. However, it is true that specific types of powder have particular merits in some instances. Thus, polystyrene mouldings have excellent resistance to moisture, vapour or liquid, provided that temperature is not too high; silica loaded polystyrene additionally exhibits improved resistance to temperature. Yet, for all-round suitability from the stability angle, the phenolics have been rightly given first place.

THE shortcomings of the phenolic-resin mouldings have been neither unknown nor overlooked. Long before the ultra-severe service conditions of the war period forced active consideration of the lack of stability of these materials, comprehensive studies had been made. This, in particular, refers to dimensional instability under various conditions. Changes in linear dimensions in all three axes had been examined under conditions of complete water immersion and dry heat, as well as under fluctuating conditions of warmth and wetness. Attempts have been made to relate these changes in the moulding with the corresponding gains or losses in weight. All this work has been performed in relation to general commercial mouldings, wood-filled, textile-filled and mineral-loaded varieties. In all of these, the lack of stability in a relative sense must be regarded as very small, and in the case of mineral-loaded phenolic mouldings extraordinarily small.

Nevertheless, with service imposing exposure in uncontrolled conditions, especially appertaining to hot and cold, wet and dry atmospheres, lengthy storage periods, subjection to tropical extremes, erratic shipment conditions and the like, phenolic mouldings have not always proved satisfactory. This has particularly been noticeable in precision equipment, both mechanical and electrical. Troubles have resulted merely from dimensional changes, which may have shown themselves in swelling or shrinkage and loss of accuracy of fit, or in distortion. They have also been experienced in electrical components, due to loss of insulation resistance. As a result of these shortcomings, there has been a tendency to insist upon mineral-loaded phenolic moulding materials; in particular, the mica-loaded type. Alternatively, or additionally, heat treatments have been imposed upon the moulding to improve its performance in the respects under discussion.

While these answers have often provided the immediate answer to specific problems, they naturally have not been regarded as finality, and equally naturally have provided the stimulus for further research and development, the results from which will inevitably be advantageous progress.

To change from wood flour to mineral-filled phenolics has not always been achieved with acclamation from all sides, nor has it always proved to be practicable. In the first place, tool changes have been involved on account of differing bulk densities and shrinkage factors. Secondly, there is greater wear on tools. Even when these factors are faced, thin sections have often proved difficult or impossible in the mineral-containing material.

Likewise, heat treatments on wood-filled mouldings have not been generally acceptable. To effect a real improvement in stability under the severest of conditions, a baking temperature as high

as 170 degrees to 180 degrees C. is generally essential. It is possible to devise a thermal cycle that is satisfactory in specific cases, and by means of which mouldings can be stabilized without warping or blistering. In others, distortion occurs and success cannot be claimed. Again, some loss of strength results, and generally it cannot be claimed that electrical insulation is stabilized by this means.

For highest insulation values under damp conditions, the mineral-filled phenolics are selected in preference to the wood-flour mouldings. Even then, mechanical or physical stability is not assured and thermal treatments are imposed to assure this feature. This is particularly emphasized if the moulding in the operating position is held under strain and exposed to elevated temperatures. The higher the temperature, the more need there is for this treatment. It has to be remembered that if the temperature rise from heat generated and dissipated due to the operating of the equipment is added to the ambient temperature, values of the order of 150 degrees C. are likely to be reached for long periods.

These facts suggest the need for a much-improved product, but they stress, too, that some discrimination must be used, preferably with respect to the choice of material and the choice of treatment, rather than anticipate a general-purposes improved product suited to all applications. It would seem that the requirements need classifying, and the following groups are suggested:—

(a) Dimensional stability under severe service conditions, including temperature and humidity effects, and with the component under strain.

(b) Dimensional stability under extra-severe service conditions, including humidity effects, the influence of high temperatures, and with the component under strain.

(c) Stability of electrical insulation under severe service conditions, including temperature fluctuations and particularly humidity effects.

It cannot be expected that a single material can be developed in the near future to satisfy all these criteria, and at the same time provide satisfaction, with respect to the all-important practical facts of easy mouldability and the production of complicated and slender shapes.

In consequence of these features, any material that satisfies one or other of the desired criteria will be welcomed. Logical lines of development for improved electrical insulation and stability of the wood-filled types include the use of a wood-flour filler preimpregnated with phenolic resin. Likewise, for improved insulation resistance, the use of organic fillers, similar to wood flour but in themselves possessing better electrical characteristics, can be explored. Nylon yarn as one type of such material, and acetylated cotton of the cotopa class as another, suggest themselves in this direction. Both of these should be readily available as "waste" or scrap from the spinning and yarn industries.

In point of fact, a recent British patent (570,529) indicates that phenolic-resin moulding powders having acetylated-cotton filler are already developed. The general availability of such mouldings is looked forward to with more than academic interest. It should be possible to meet all the needs of the practical moulder with respect to manipulation and, at the same time, provide improved properties of shock resistance, electrical insulation, resistance to water absorption and, consequent upon the latter, stability and fluctuating conditions of dampness and heat.

Some information appertaining to the influence of fillers upon the dimensional stability of phenolic resins is given in Table 1. Weight changes under the test conditions are also shown. The data refers to tests on specimens under each of the following conditions:—

(a) Dampness — complete water immersion at ordinary temperatures.

TABLE I.—RESULTS OF ACCELERATED DURA

Test conditions and changes recorded in moulding	SECTION 1 Unloaded cast phenolic resin (amber and coloured varieties, sp. gr. 1.34)			SECTION 2 Wood flour filled (mineral filling and pigmentation nil, sp. gr. 1.31)			Wood (min
	Test period extended to :—			Test period extended to :—			Test p
	1 day	7 days	21 days	1 day	7 days	21 days	1 day
Complete immersion in distilled water at 20°C.—							
Gain in weight (per cent.)	0.10	0.50	1.30	0.25	0.80	2.0	0.30
Increase in dimensions (per cent.) :							
Length	Negligible	0.10	0.30	Nil	0.06	0.42	Nil
Width	Negligible	0.10	0.35	Nil	0.12	0.50	Nil
Thickness	Negligible	0.60	1.35	Nil	0.16	0.45	Nil
Continuous dry heat at 70°C.—							
Loss in weight (per cent.)	1.3	2.9	4.3	0.55	1.35	2.35	0.60
Decrease in dimensions (per cent.) :							
Length	0.50	1.0	1.4	0.10	0.20	0.35	0.10
Width	0.55	0.85	1.5	0.15	0.25	0.42	0.20
Thickness	0.30	0.85	1.2	0.20	0.40	0.60	0.05
Continuous dry heat at 110°C.—							
Loss in weight (per cent.)—	2.4	6.3	8.7	0.85	3.15	3.95	0.80
Decrease in dimensions (per cent.) :							
Length	0.90	2.1	2.7	0.50	0.72	0.85	0.45
Width	0.90	2.0	2.6	0.65	0.80	0.95	0.50
Thickness	0.50	1.5	2.5	0.45	0.65	1.00	0.10
Cyclic warm and cold humidity conditions—							
Change in weight (loss per cent.)	0.10	0.25	0.40	0.05	0.15	0.80	0.20
Change in dimensions (per cent.) :							
Length	Negligible	0.10	0.25	Negligible	Negligible	0.2 loss to 0.3 gain	
Width	Negligible	0.07	0.20	Negligible	Negligible		Negl
Thickness	Negligible	Negligible	0.10	Negligible	Negligible		

(b) Heat—continuous exposure to the moderate dry heat of 70 degrees C.

(c) Heat—continuous exposure to the more severe dry-heat conditions of 110 degrees C.

(d) Combined heat and dampness—a daily cycle of eight hours at 55-60 degrees C. with 65-75 per cent. humidity, and 16 hours, including cooling down to room temperature, of 18-22 degrees C. and 100 per cent. humidity with condensation upon the specimens.

In Table 1, section 1 refers to cast-phenolic resins of the more stable amber or coloured varieties, included to represent the basic plastic material. It will be noted that the effect of water immersion is more than would be expected, and that most instability is towards dry heat.

Section 2 appertains to ordinary wood-flour-filled phenolic-resin mouldings. Broadly speaking, the material has become a little less stable to water, but more stable under thermal conditions.

Section 3 indicates the influence of a small percentage of mineral loading or pigment with the wood filler; on the whole, the product is little different from the wood-filled mouldings.

Section 4 deals with special paper-filled mouldings of the phenolic-resin type. The product is much less stable under wet and damp conditions, and not nearly so good as the wood-filled moulding powder under heat, although superior in this direction to the resin itself.

Section 5 gives details of mouldings with high mineral loading—about 33 per cent. Again, the values are not sufficiently different from those given for the wood-filled material to warrant distinctive comment.

Section 6 deals with mineral-filled phenolic-resin mouldings having about 60 per cent. of mica as the filler. It is in these that a sharp improvement is notice-

DURABILITY TESTS ON PHENOLIC MOULDINGS

SECTION 3 Wood flour/mineral filled or pigmented (mineral loading 8/10% sp. gr. 1.45)			SECTION 4 Paper/mineral filled (mineral loading 10.0% sp. gr. 1.58)			SECTION 5 Mineral filled (mineral loading 33.0% sp. gr. 1.75)			SECTION 6 Mica filled (mineral loading 60.0% sp. gr. 1.80)		
Test period extended to :—			Test period extended to :—			Test period extended to :—			Test period extended to :—		
1 day	7 days	21 days	1 day	7 days	21 days	1 day	7 days	21 days	1 day	7 days	21 days
2.0	0.30	0.85	2.05	1.1	3.6	4.8	0.12	0.67	1.5	0.10	0.35	0.50
0.42	Nil	Nil	0.30	1.10	1.85	2.10	0.02	0.20	0.55	Negligible	Negligible	Negligible
0.50	Nil	Nil	0.20	0.50	1.00	1.45	0.05	0.38	0.84	Negligible	Negligible	Negligible
0.45	Nil	Nil	0.15	0.95	4.10	5.50	0.10	0.40	0.53	Negligible	Negligible	Negligible
2.35	0.60	1.55	2.90	2.05	3.1	4.0	0.36	0.94	1.56	0.24	0.62	1.02
0.35	0.10	0.27	0.35	0.70	0.85	1.0	0.10	0.31	0.55	0.10	0.33	0.45
0.42	0.20	0.45	0.73	0.20	0.30	0.45	0.16	0.40	0.53	0.04	0.14	0.20
0.60	0.05	0.20	0.38	0.32	0.45	0.80	0.04	0.08	0.36	0.10	0.14	0.28
3.95	0.80	2.75	3.70	3.0	4.5	5.0	0.52	2.7	3.1	0.38	1.8	2.0
0.85	0.45	0.68	0.80	1.35	1.45	1.75	0.58	0.95	1.00	0.20	0.65	0.90
0.95	0.50	0.75	1.00	0.35	0.55	0.60	0.70	0.86	0.95	0.05	0.10	0.30
1.00	0.10	0.25	0.60	1.00	1.05	1.85	0.24	0.68	1.10	0.15	0.30	0.45
0.80	0.20	0.45	0.70	0.10	0.50	1.5	0.01	0.01	0.15	Negligible	Negligible	Negligible
0.2 loss to 0.3 gain	Negligible, max. variation plus and minus 0.05			Fluctuating increases from 0.10 to 0.70			Fluctuating increases and decreases to extent of plus and minus 0.05			Negligible Negligible Negligible	Negligible Negligible Negligible	Negligible Negligible Negligible

able under all the conditions which are set forth.

Table 2 offers some rather specific test results, namely, dimensional movement when exposed to steam and when re-dried by baking. In these respects, the mineral-filled materials stand out markedly, including those from 40-60 per cent. of mineral filler, leaving the ordinary wood-filled mouldings in a lower class by themselves.

To convey a more rapid visualization of these stability values, they are shown graphically in Figs. 1 to 6 inclusive.

In Fig 1, the values from Table 2 have been utilized to show the approximate relationship between the content of mineral filling and the movement when exposed for eight hours to steam at 100 degrees C. The minimum, maximum and mean values have been plotted on separate curves. When it is realized that these represent a large number of test results, the stability of mouldings having a mineral filler of 40 per cent. and over is demonstrated. Fig. 2 deals with the final deviation from the original dimensions after steam and heat test in similar manner (eight hours in steam at 100 degrees and half-hour at 150 degrees C.).

Fig. 3 covers the water-immersion tests, Fig. 4 the heat tests at 70 degrees C.; Fig. 5, those at 100 degrees C., with movement plotted against time. In every case, the curve for the 60 per cent. mineral-filled mouldings lies at the bottom of the picture in outstanding fashion. Similar remarks apply to Fig. 6 for the cyclic humidity tests, with the 60 per cent. filled mouldings lying along the zero line.

With respect to electrical insulation properties, tests lead to the same choice, namely, the high mineral-loaded material, for all applications where this is important. At the same time, other features have to be carefully considered if the maximum anticipated electrical insulation is to be achieved. Thus, cracks and

Table 2.—Stability of Phenolic Mouldings, Cylindrical Shape, Open One End, when Subjected to 8 Hours in Steam at 100°C. Followed by ½ Hour Dry Heat at 160°C.

Type of filler	Mineral filler (per cent)	Sp. gr. at 15.5°C.	Change in thousandths of an inch from original diam. of 1.5 ins.					
			After steam test			After steam plus heat test		
			Max.	Min.	Mean	Max.	Min.	Mean
Wood flour	nil	1.34	+56	+35	+43	+7	−3	+2
Mineral loading ..	33.3	1.70	+8	+1	+4	+5	−2	+0.2
Mineral loading ..	39.5	1.62	+5	+1	+3	−5	+1	−2
Mineral loading ..	44.0	1.66	+4	+2	+2.5	−4	+3	−0.5
Mineral loading ..	51.5	1.62	+3	nil	+1.5	+2	−2	−0.5
Mineral loading ..	56.0	1.81	+3	nil	+1	−4	nil	−0.5

surface cracks have to be avoided, tests after humidifying often revealing flaws that were not at first obvious. This is especially the case with complex shapes, particularly if various sections in the same moulding vary widely or abruptly in thickness, and around metal inserts. If fettling, as in flash removal, is along critical surfaces, lines of weakness may result and surface varnishing may become essential.

The foregoing remarks are of a broad and general nature, and in their unbiased strain they warn against considering the mineral-filled mouldings as a solution to all problems, or even as a complete solution to any problem. It is from this outlook, and from the viewpoint of rational progress, that the cotopa-filled phenolic moulding powders are looked for with more than interest. Incidentally, it is with no idle optimism that the possibilities of this new product are viewed.

The use of acetylated cotton fabric has already been practised extensively with success as a filler for phenolic resins. It has thus been used in laminated sheet and rod forms comparable with the synthetic-resin-bonded fabric sheet products of electrical grade. The impetus to its production was the need for superior electrical properties of this type of material under

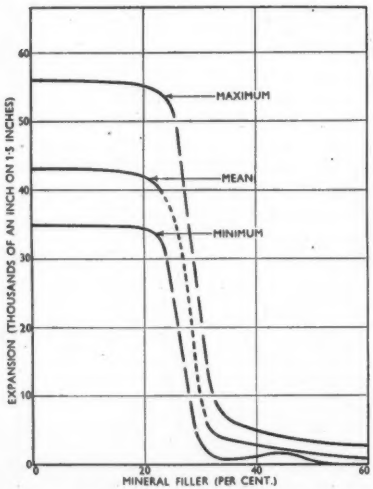


Fig. 1.—Expansion of mouldings, 8 hours in steam at 100° C.

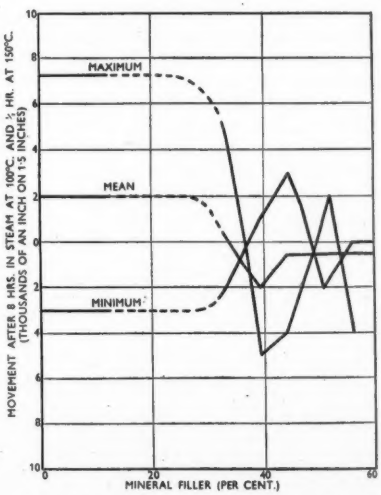

MOVEMENT AFTER 8 HRS. IN STEAM AT 100°C. AND ½ HR. AT 150°C. (THOUSANDS OF AN INCH ON 1·5 INCHES)
MAXIMUM
MEAN
MINIMUM
MINERAL FILLER (PER CENT.)

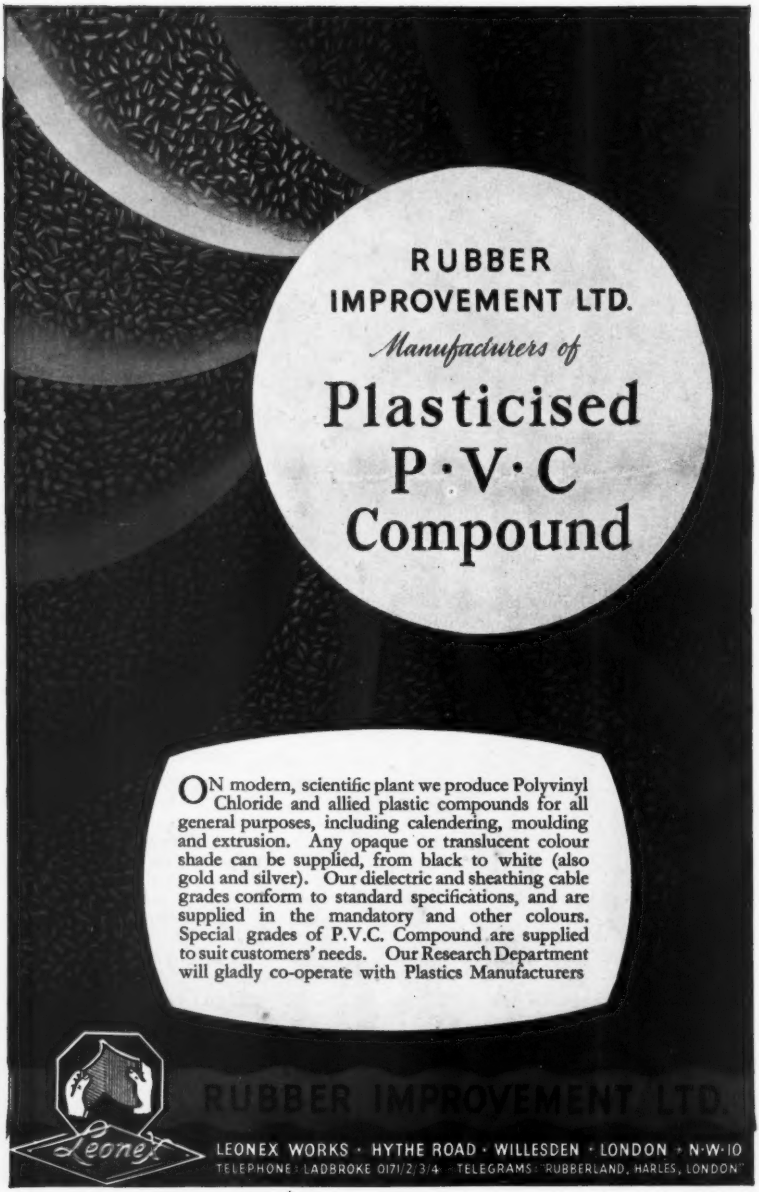
Fig. 2.—Movement in mouldings after steam and heat tests.

At last! Monsanto's LUSTRON — the new and improved polystyrene moulding compound—is now being delivered in quantity from stock. With faster moulding properties, LUSTRON — the no-waste low-priced moulding material of the future is here today; to give colourful, jewel-like beauty and added sales appeal to your products. Write for full information on how you can profit by LUSTRON to Plastics Sales Department, Monsanto Chemicals Limited, Victoria Station House, London, S.W.1.

MONSANTO CHEMICALS

QUICK FACTS ABOUT LUSTRON . . . Low cost per pound . . . Lightweight . . . Faster moulding . . . New brilliance and clarity . . . No taste or odour . . . High dimensional stability . . . Excellent electrical qualities . . . Gay colour range.

SERVING INDUSTRY WHICH SERVES MANKIND


RUBBER
IMPROVEMENT LTD.
Manufacturers of
Plasticised
P·V·C
Compound
ON modern, scientific plant we produce Polyvinyl Chloride and allied plastic compounds for all general purposes, including calendering, moulding and extrusion. Any opaque or translucent colour shade can be supplied, from black to white (also gold and silver). Our dielectric and sheathing cable grades conform to standard specifications, and are supplied in the mandatory and other colours. Special grades of P.V.C. Compound are supplied to suit customers' needs. Our Research Department will gladly co-operate with Plastics Manufacturers
Leonex
LEONEX WORKS · HYTHE ROAD · WILLESDEN · LONDON · N·W·10
TELEPHONE: LADBROKE 0171/2/3/4 TELEGRAMS: "RUBBERLAND, HARLES, LONDON"

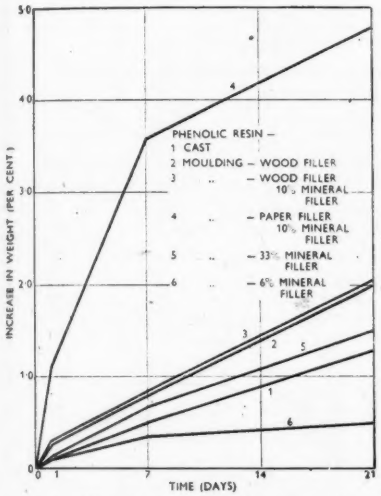

INCREASE IN WEIGHT (PER CENT.)
TIME (DAYS)
PHENOLIC RESIN —
1 CAST
2 MOULDING — WOOD FILLER
3 .. — WOOD FILLER 10% MINERAL FILLER
4 .. — PAPER FILLER 10% MINERAL FILLER
5 .. — 33% MINERAL FILLER
6 .. — 6% MINERAL FILLER

Fig. 3.—Weight changes during immersion in water.

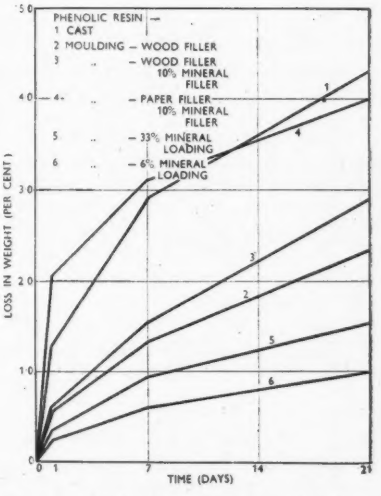

LOSS IN WEIGHT (PER CENT.)
TIME (DAYS)
PHENOLIC RESIN —
1 CAST
2 MOULDING — WOOD FILLER
3 .. — WOOD FILLER 10% MINERAL FILLER
4 .. — PAPER FILLER 10% MINERAL FILLER
5 .. — 33% MINERAL LOADING
6 .. — 6% MINERAL LOADING

Fig. 4.—Weight changes on extended dry heat at 70° C.

damp conditions, especially insulation resistance, yet retaining its good mechanical attributes, particularly impact resistance.

Some comparative data on synthetic-resin-bonded fabric, plain and acetylated cotton, are given in Tables 3 and 4. These data refer to water content, water absorption and weave. No other information to illustrate the properties of the material is available at the moment.

The following notes from the recent patent for cotopa-filled moulding powders, and from another patent referring to the acetylation process, are pertinent.

British Patent 570,529 of Cotopa, Ltd., and E. Chippindale, 1945, is of special interest in that it covers the use of what is, in effect, cotopa cotton, that is, acetylated cellulose fibres, as a filler for moulding powders. Normally, moulding powder consists of synthetic resin with which is incorporated wood flour or ground-up rags, or any other miscellaneous textile material, when shock resistance is required. Mechanical properties are relatively good, but electrical characteristics leave something to be desired.

It can generally be stated that there is a lowering of insulation resistance due to

Table 3—Comparison Values on Synthetic Resin Bonded Fabric Sheet—Ordinary Fabric and Acetylated Cotton Fabric.

Type of fabric	Thickness (inches)	Water content, loss on heating 1½ sq. sample, 6 hrs. at 110° C.		Water absorption, 24 hrs. at 20° C. on 1½ sq. sample.		Weave of fabric, threads per inch
		mgm.	per cent.	mgm.	per cent.	
Ordinary cotton	¼	—	1.2	—	0.32	78 × 76
	⅛	1,100	2.9	127	0.30	48 × 52
Acetylated cotton	¼	—	1.3	72	0.30	48 × 52
	⅛	270	1.0	58	0.18	48 × 52
	⅛	340	1.1	54	0.17	48 × 52

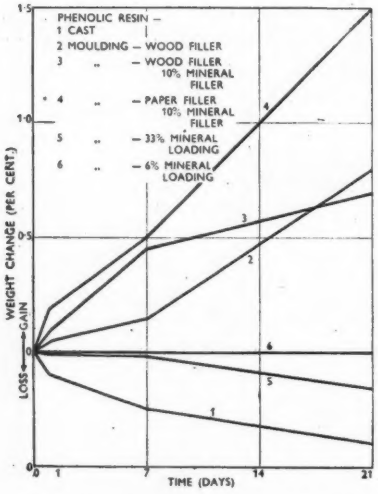

PHENOLIC RESIN –
1 CAST
2 MOULDING – WOOD FILLER
3 " – WOOD FILLER 10% MINERAL FILLER
4 " – PAPER FILLER 10% MINERAL FILLER
5 " – 33% MINERAL LOADING
6 " – 6% MINERAL LOADING
WEIGHT CHANGE (PER CENT.)
LOSS ← → GAIN
TIME (DAYS)

Fig. 5.—Weight changes on extended dry heat at 110°C.

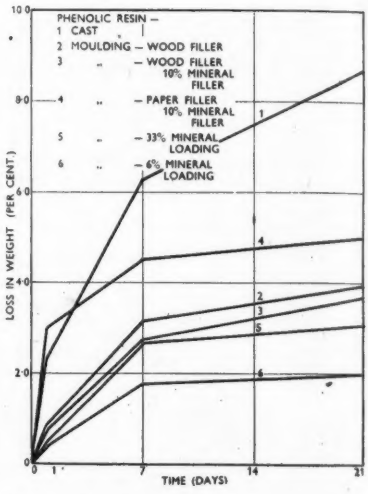

PHENOLIC RESIN –
1 CAST
2 MOULDING – WOOD FILLER
3 " – WOOD FILLER 10% MINERAL FILLER
4 " – PAPER FILLER 10% MINERAL FILLER
5 " – 33% MINERAL LOADING
6 " – 6% MINERAL LOADING
LOSS IN WEIGHT (PER CENT.)
TIME (DAYS)

Fig. 6.—Weight changes on cyclic temperature/humidity test.

the poor electrical properties of the fillers employed. It is known that cellulose fibres, such as cotton, can be improved appreciably with respect to moisture absorption, the rate at which water is absorbed and, in consequence, with respect to electrical insulation resistance and retention of resistance values under humid conditions. This material is represented by the well-known cotopa cotton, a material which is no longer cellulose, but approximately the mono-acetate ester.

Table 4.—Laboratory Characteristics of Synthetic Resin Bonded Fabric Rod and Tube—Ordinary and Acetylated Cotton Types.

Type of Fabric	Size	Water Content, 1½ in. length, 6 hrs. at 110°C. (per cent.)	Water Absorption, 1½ in. length, 24 hrs. at 110°C. (per cent.)
Acetylated cotton	½ in. diam. rod	0.65	0.19
	1½ in. diam. rod	0.90	0.62
	1½ in. o/d × ¼in. i/d tube	0.75	0.34
Plain cotton	½ in. diam. rod	1.30	0.57
	1 in. diam. rod	2.55	0.83
	1.5 in. diam. rod	1.43	0.50
	1.0 in. o/d × ½ in. i/d tube	2.25	0.55
	⅞ in. o/d × ½ in. i/d tube	2.20	0.58

The patent covers the use of this material, namely, a filler of chopped or ground fibres of cellulose acetate obtained by the acetylation of cellulose with the maintenance of its fibrous structure. For the purpose, fibres of cellulose, acetylated to a degree corresponding to that from cellulose mono-acetate to the diacetate, are stated to be particularly suitable. Such fibres can be obtained by utilizing the waste produced when winding acetylated cellulose yarns or, alternatively, by the acetylation of the rejected fibres which accumulate in cotton spinning.

As an example of the method of acetylation, British Patent 570,529 cross-refers to British Patent 280,493.

These fibrous acetylated-cotton fillers may be employed in both thermosetting and thermoplastic types of synthetic-resinous moulding powders, but the invention covered by the patent does not include the use of non-resinous cellulosic plastics, such as those based on cellulose acetate.

(*To be continued*)

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired.

Lavatory Seats

Sir,—We have been particularly interested in the letters contained in your June and August issues on the subject of the design of lavatory seats. Since this company has been for the past 60 years actively engaged in the manufacture of such articles, it can claim with all modesty to be fully aware of modern requirements and demands.

The British Standard Specification first of all demands a flat underbase, and further, manufacturers are advised that both closed and open front seats with such underbase do comply with the specification.

Modern hygiene demands, and rightly so, that certain works, public conveniences, hotels, hospitals, etc., should have lavatories fitted with open front types. It would be futile to ignore the advice of the medical profession who are mainly responsible for the control of hospitals, institutions, etc., and we need not seek any further confirmation on this point.

Again we would state that material should not be confused with design, although it must be freely admitted that the plastic lavatory seat is a distinct advancement in the application of available materials, and in our considered opinion far exceeds the possibilities of wood or any other material.

ROBERT MCARD AND CO., LTD.,
Crown Works,
Denton, Manchester.

Toothbrush Holders

Sir,—One of our Dutch customers, to whom we have supplied a British toothbrush-making machine and a trimmer, now wishes us to procure plastic toothbrush holders and we should be most grateful for suitable introductions.

COMINTRA, LTD.
Burtons Way,
Chalfont St. Giles, Bucks.

Plastics as Living Materials

Sir,—In congratulating the Plastics Institute and thanking you for publishing the excellent article by Mr. G. H. Friese-Greene on "Plastics as Living Materials," I would urge you, even with the limitation of paper, to make it available as sheets to all those who are in any way concerned in the training of designers and craftsmen for this modern age, whether in art or technical institutions, schools or industry.

KENNETH HOLMES, Principal.
Leicester College of Art.

Plastic Rods

Sir,—Customers of ours in the Middle East require supplies of plastic rods in amber colour for the manufacture of rosary beads. The rods should be approximately 1 metre long and be supplied in diameters ranging from 6 mm. to 28 mm. We would be obliged if you would recommend a few firms who could offer, and also suggest a suitable plastic.

BRITISH UNICORN, LTD.
36-38 Southampton Street,
Strand, London, W.C.2.

[EDITOR'S NOTE: If transparent or translucent amber coloured rods are required, casein, cast phenolic or urea resin or methyl methacrylate would be quite suitable in extruded rod or cast form. Casein can be obtained from Aberdeen Combworks Co., Aberdeen; Combined Plastics, Lewin's Mead, Bristol; Erinoid, Ltd., Stroud; Halex, Ltd., London; and Chas. Horner, Ltd., Halifax; cast resins from Catalin, Ltd., Waltham Abbey, and United Ebonite and Lorival, of Little Lever, Bolton; "Perspex" from I.C.I., Plastics Division, Welwyn Garden City.]

Bookbinding Rings

With reference to the inquiry in "Plastics," July, 1947, page 380, we understand that Nevett, Ltd., Colindeep Lane, Edgware Road, London, N.W.9, are suppliers of this type of binding.

PLASTICS IN GERMANY

The New Target in Germany is the Science behind the Industries. The following are additional Notes from the Official Reports which can be obtained from H.M. Stationery Office

F.I.A.T. Final Report No. 446.—This report deals with the glues, resins and plastic products made by various chemical concerns for aircraft tooling and fabrication. The plastic material most widely used for aircraft tooling in Germany was a resin stabilized wood veneer called "Pressholz." This material consists of layers of thin beech veneer, cross banded, and bonded by either Tego film or liquid resin. It resembles "Compreg," as used in the United States, except for a much lower resin content (25 per cent.) and thinner layers of veneer (average thickness 1 mm.). Pressholz was used for form blocks, stretch press dies, draw dies, drill and assembly jigs, gears, routing fixtures, etc. Materials for fabrication of aircraft parts include "Dynal," a plastic impregnated paper pulp made by Dynamit A.G., at Troisdorf, and "Moltopren," a sponge foam plastic made by I.G., at Leverkusen. Polyvinyl chloride was widely used for cable covering and cockpit lining. Moltopren is based on a di-isocyanate resin. It is a light density material similar to the foam plastics produced in the United States, sp. gr. 0.06, and is reported to be capable of supporting 8 kg. per sq. cm.

F.I.A.T. Final Report No. 724.—Miscellaneous chemical processes and plastics machinery are covered by this report, which is in four parts: (1) polymerization of styrene, (2) polystyrene moulding compounds, (3) p.v.c. sheeting, and (4) plastic zippers. Lengthy details are given concerning the manufacture of the type III polymer of styrene, including regulation of temperature; this polymer is mass polymerized and then continuously tower polymerized, its mol. wt. (ultra centrifuge method) is 150,000, and its main application is standard injection moulding. In the present tower method no polymer with higher molecular weight than type III could be produced; less viscous polymers will not flow satisfactorily in the vertical tower. The tower output reaches its limit at one ton per day, because any increase in tower diameter is objectionable for sake of heat transfer. The colouring of polystyrene by mill mixing was to be replaced by extrusion methods, but even if lower costs resulted there would still be the necessity for the heating and softening to allow the incorporation of colour.

A visit to Norddeutsche Seekabelwerke, at Nordenham, revealed information upon experiments in extruding fine threads of polystyrene, which had a tensile strength of about 900 kg. per sq. mm. These threads, however, were brittle. Cloth had been woven from the threads, but the cloth was also brittle, and the only suggested use for it was as a filter cloth at relatively low temperatures for solutions which do not attack polystyrene.

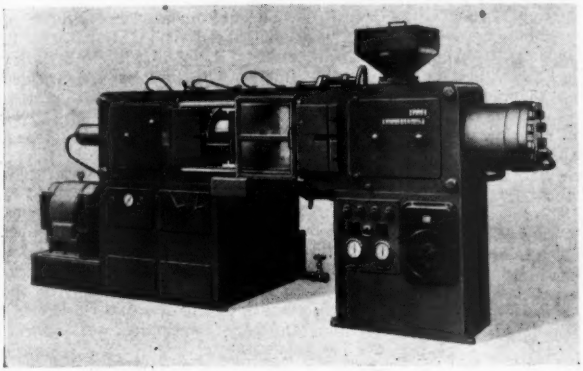
The chief use of polystyrene film (successfully produced at Nordenham in thicknesses as low as one hundredth of a millimetre) was in making a new type of electric cable in which narrow strips of Styroflex were wound about a copper wire in an endless helix, the strips being built up of many layers and the outside then covered to form a tube with use of wider strips of Styroflex. Such a cable has considerable flexibility, and for certain uses was extremely satisfactory, as in the case of television equipment, and for submarine use (where it was still further protected by being enclosed in a flexible steel tube).

F.I.A.T. Final Report No. 856.—Detailed procedures for the preparation of commercially important polyvinyl ethers, including the solid, oily, resinous and waxy Igevins, are given in this report. The entire series are prepared by rather simple mass polymerization methods, using acidic catalysts, particularly boron

(Continued on page 506)

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



INJECTION MOULDING MACHINES

The Projectile and Engineering Co., Ltd., of Acre Street, Battersea, S.W.8, have in production a new design in self-contained, hydraulically operated, automatic cycle injection moulding machines which are intended to meet exacting requirements of the plastics industry. On a recent visit to their works we inspected one of these machines (8-oz. capacity) in operation, and saw others (4 oz.) in various stages of construction. Apart from proved features, they claim a number of advantages which give the operator high output, freedom from operating troubles, and easy maintenance.

These machines are built on a unique three-unit principle which can be sub-divided into (1) main plate and operating assembly, (2) hydraulic control base, (3) electrical and heat control.

The main plate assembly, on the plate frame principle, was chosen because of its advantages over tie-bar type machines. The greater area of section gives increased rigidity in every direction, reduced elongation and deflection, and avoids trouble due to flexing of tie-bars. This construction also gives greater mould space, and easier access to the mould. The heavy guiding bushes of the mould platens are run on hardened steel strips, ensuring long life.

Mould closing is carried out by four sets of fully balanced quick-acting toggles, with toggle pins mounted in special wear resisting sleeves. The area of toggle thrust has been designed to cover the critical points for moulding, and to eliminate deflection. Adjustment of the moving platen for mould height is carried out by means of an easily operated central adjusting screw, which takes the stress set up by moulding pressures over a more than adequate area. The toggle mechanism and all bearing surfaces are automatically lubricated by means of a centrally fitted lubrication system.

The moving platen is made of 5-in. solid steel, and has integrally mounted bronze bearings with easy adjustment for wear. The headstock platen, which is of 6-in. solid steel, is provided with a tapered cam-type mould to nozzle adjustment, which dispenses with the rather cumbersome and often inaccurate method of adjusting nuts on tie-bars.

The heating cylinder has been designed to give maximum heating efficiency with long trouble-free life. The cylinder consists of a barrel made from solid stainless steel with a spreader integral with the barrel, thereby eliminating all chance of leakage, charring of material, and other causes of rejects; it gives the maximum heat transfer from the heating area to the surface of contact between the material and the cylinder. The heating of the cylinder is performed by cartridge elements, instead of the usual external band heaters; this not only gives a better heating efficiency, but also much longer life. Temperature control and heat input control is performed by a Bristol "Pyrodictor"; very sensitive temperature control is obtained, and heat input is automatically regulated to suit the working temperature.

The hydraulic control base consists of a completely self-contained unit which is

separate from the electrical and all other operating assemblies. This base has a built-in oil tank with a capacity of 100 gallons. The hydraulic circuit provides a fool-proof safety gate mechanism, preventing any movement whilst the safety gate is open. All the valve gear and piping are mounted externally on a rigid frame; by removing a cover the whole circuit is exposed, thus ensuring easy maintenance.

A notable advantage of this three-unit principle is that it gives a completely free section of the machine, to enable the user to put trolleys or boxes for the ejected mouldings right underneath the machine, thereby saving floor space, and providing a clear working space for the operator.

Two automatic safety features are fitted: first, to prevent injection taking place before the closing of the moulds; secondly, to prevent closing of the mould should the safety gate be open.

The 8-oz. machine has a plasticizing capacity of 60 lb. per hour, with a hopper capacity of 55 lb. The maximum mould locking pressure is 250 tons; pressure on material, 20,000 lb. per sq. in.; stroke of injection plunger, 10 ins.; rate of injection, 12.3 cubic ins. per second. The overall size of the die plates is 26¼ ins. by 21½ ins.; die clearance between guides, 16¼ ins. by 14¾ ins.; maximum and minimum die thickness 16 ins. and 7 ins. respectively.

PLASTICS IN AUSTRALIA.—An "Australian Plastics Trade Directory" has been published for the Plastics Institute of Australia. It contains an alphabetical index to plastics and allied trades throughout the Commonwealth, classified lists of manufacturers of plastic materials and products, and machinery and general chemicals used by the industry. There is also a guide to trade names.

TIPPED TOOLS.—Instructions for brazing and grinding "Prolite" tungsten carbide tips and tipped tools are set out in a 32-page booklet issued by Protolite, Ltd., Central House, Upper Woburn Place, London, W.C.1. This booklet contains much useful information, with data upon recommended speeds and feeds for turning tools, and is illustrated in a manner which sets a high standard for manufacturers' technical literature.

THE BOARD OF TRADE have appointed Mr. F. S. Tredennick to be Registrar of Companies in place of Mr. P. Martin, who has retired.

THE BRITISH PLASTICS FEDERATION are holding a conference at Bournemouth, commencing Thursday, October 2, and terminating Monday, October 6. The business session on Friday morning will include papers on "The Future of Thermosetting Plastics" (Mr. C. H. Glassey and Mr. P. A. Delafield) and "The Future of Thermoplastic Materials" (Mr. L. P. B. Merriam and Mr. P. C. Allen). On Saturday morning there will be papers entitled "Whither the Industry?" (Mr. H. V. Potter, Mr. J. E. Beard and Dr. W. J. Worboys). Various social activities have been arranged.

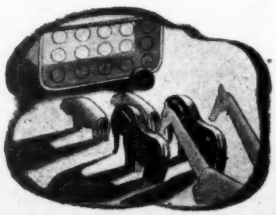
TRADE VISITS TO GERMANY.—The Board of Trade have been informed that as the result of improved facilities in Germany it will be possible for an increased number of business men to visit the joint U.K./U.S. Zones of Germany to buy goods and services. Applications should be sent to the German Division, Board of Trade, I.C. House, Millbank, London, S.W.1. Firms are reminded that trading with Germany is subject to the normal import licensing and exchange control regulations.

MACHINE TOOLS.—Owing to a heavy development programme, A. C. Wickman, Ltd., Coventry, have relinquished their agreement with the Kearney and Trecker Corporation covering the manufacture and the sale of Milwaukee machines in this country. As from September 15, 1947, C.V.A. Jigs, Moulds and Tools, Ltd., have obtained the manufacturing rights for all Kearney and Trecker machine tools, and E. H. Jones (Machine Tools), Ltd., London, N.W.9, have been appointed the sole selling agents for the complete range.

LAMINATED INSULATION. — The many uses of "Permali" laminated material which combines a high strength-weight ratio with excellent insulating properties, are described in a new data book, which is available from The New Insulation Co., Ltd., Gloucester. Of special interest to designers is Section B, which deals with electrical, physical, and mechanical characteristics.

EAST ANGLIA CHEMICAL CO., LTD., of Aycliffe, Darlington, announce that their managing director, Mr. T. C. Usher, has been invited to join a panel of technicians to advise the South African National Bureau of Standards, which is drawing up specifications to cover all plastic and synthetic materials used for insulating electric wire and cable throughout the Union of South Africa.

Plastics go to the nursery



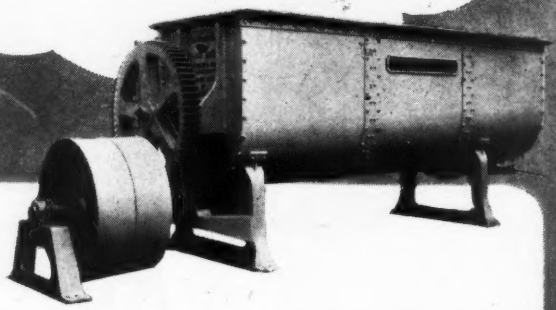
Plastics from I.C.I. are literally all over the room. The toys, table-ware, fabrics, lights and furniture have all benefited from the use of strong, clean, colourful plastics.

ICI

P.271

POWDERS IN PLASTICS

GARDNER'S
MACHINERY
for the Plastic Industry



Shown here is a GARDNER Patent "Rapid" Mixer, for the efficient mixing of large batches of powders in varying proportions. This is just one of many machines designed for effective processing of powders in large or small batches. Sifting and Mixing, Sieving, Dressing or complete Elevating and Feeding Plants.

A special Grinder has been designed for reducing cellulose acetate scrap from moulds, allowing re-utilisation whilst the batch is in actual operation.

Let us send you our illustrated catalogue of our many machines designed for your particular problems.

WM. GARDNER & SONS (Gloucester) LTD., BRISTOL RD., GLOUCESTER
Telephone: 2288 (3 lines) *Telegrams: "Gardner, Gloucester"*
LONDON: 19, GRAY'S INN CHAMBERS, 20, HIGH HOLBORN, W.C.1
Telephone: Chancery 7347

MR. H. RONALD FLECK, M.Sc., F.R.I.C., of "The Beacon," Main Road, Biggin Hill, Westerham, Kent, has been appointed technical adviser to the Kunststoffeninstitut T.N.O., Plastics Division, in Delft, Holland. He will be pleased to receive inquiries concerning plastics research in Holland.

A. C. WICKMAN, LTD., regret to record the death of Mr. George W. Clarke on August 16, aged 62 years. The late Mr. Clarke was a specialist on gear and spline grinding and had been with Wickmans since 1938; previously he was works superintendent at the Gear Grinding Co., Birmingham.

CRYSTALATE, LTD., have recently taken over the plant, etc., of Mica Products, Ltd., manufacturers of laminated plastics and "Micanite" tubes, laminated bobbins and formers, mica and "Micanite" insulations, stampings, punchings and machinings of laminated sheet, "Presspahn" tubes, bobbins and stampings, and "Perspex" fabrications.

In addition, Mica Products, Ltd., operate an extensive range of compression and injection presses of the latest types, and maintain one of the most up-to-date tool shops in the industry.

The acquisition of Mica Products represents an important extension of the activities of the Crystalate Group, of which Sir Herbert Morgan is chairman. The manufacturing companies comprise Crystalate, Ltd., with two factories at Tonbridge, Kent; The British Homophone Co., Ltd., and Ebonestos Industries, Ltd., at New Cross, London, and Mica Products, Ltd., at Dalston, London. These four factories specialize in different types of work and operate independently of each other, but all technical knowledge and the diverse manufacturing resources are pooled.

Six senior executives of the Crystalate, Ebonestos and Homophone companies have been elected to seats on one or other of the boards of directors. Mr. W. H. Camden, general works manager, who has been with Ebonestos for 37 years, has been made a director of Ebonestos and Mica Products. Mr. E. E. Wood, who has been in the industry for 25 years and contracts manager for Crystalate for 10 years, has been made a director of Mica Products. Mr. J. S. Coupland, chief accountant of Ebonestos, becomes a director of that company, with which he has been associated for 33 years. Mr. W. F. Kearnes, secretary of The Homophone Co., and of Ebonestos, for 28 years, has been made a director of The British Homophone Co. Mr. E. G. Bell, associated with Crystalate for over 28 years, and Mr. D. P. Chalklin have been made directors of Crystalate (Printing), Ltd.

A get-together dinner was held at Oddenino's Restaurant, London, recently, when over 120 senior executives and heads of departments of the companies concerned were entertained. It is of interest that Crystalate, Ltd., and Ebonestos Industries, Ltd., are both approaching their jubilees of 50 years in the plastic industry.

Welcome Guest

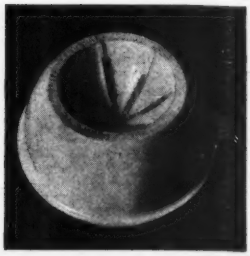
H. H. Edwards, the subject of our photograph and director of Morcom-Green and Edwards, Ltd., of Victoria Street, Onehunga, Auckland, New Zealand, has been on a visit to this country for a month, renewing old acquaintances and making new contacts in the plastics industry.

His company, which is one of the most important chemical concerns in Auckland, is especially interested in synthetic resin emulsions and glues for application on plywood and other structures. He is returning to New Zealand via the United States to make additional contacts there.

Both he and Mr. Morcom-Green have long been friends of this journal. There is much evidence for this in the fact that while no doubt they are busy making chemicals, a great deal of their time is taken up in sending food parcels to this country.

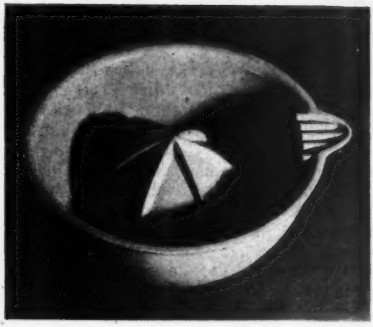
Pleasant journey, Harry, and—good hunting!

New Productions from the Moulding Shops



Clothes Pegs

Polystyrene is used for the manufacture of these clothes pegs by Airfix Products, Ltd., 24-26, Hampstead Road, London, N.W.1. The elasticity of the material in conjunction with the details of design is such that the pegs prove to be amazingly strong and will continue to grip articles on the line even in high winds. There are a large number of colours to choose from, ranging from pastel shades to vivid hues. The hole at the top of the peg is there for technical reasons; at the same time it serves a useful purpose in that the pegs may be threaded on a pilot line and kept permanently in place for casual and instant use.

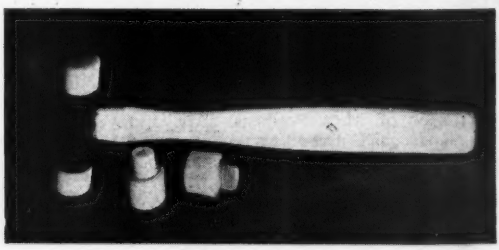


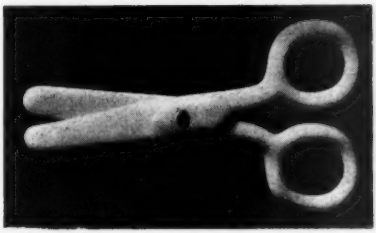
Plastic Hammer

Hammers, as most metal technologists and workers know, are not always made of steel. Copper and raw-hide heads have long been used on jobs which require blows of various degrees of hardness, or perhaps we should say delicacy, on soft or thin materials. The accompanying photograph shows the Thorex plastic hammer made by The Thor Hammer Co., of Salop Street, Birmingham, 12. The faces are of moulded "Alkathene" and screw into each end of the solid steel head. Spare faces are readily available, and the replacement takes a few seconds only to effect. The "Alkathene" moulding is extremely wear-resisting and tough, and is unaffected by oil or water.

Lemon Squeezer and Grater

The combined squeezer and grater by Monolines, Ltd., 9, Tudor Chambers, London, N.22, serves two purposes. It permits the squeezing of the lemon in the usual manner when cut halves of the fruit are pressed upon the cone; it will also evenly grate the rind when a whole lemon is placed in the depression on the underside and there turned in one or other direction. The juice cup is provided with a grid at the lip to keep back any pips when pouring off the juice. The squeezer is moulded in "Beatl" in one piece, with insets of non-corrosive nickel silver to provide the teeth for grating the rind.





Scissors for Children

The "Beeju" safety scissors for children's use, by E.V.B. Plastics, Ltd., Pear Tree Hill, Brighton Road, Salfords, Redhill, Surrey, will readily cut paper but nothing else. They are designed to be completely harmless in the hands of a child, "points" of blunt shape additionally being provided to avoid personal injury. The material employed is "Lustrac" pearl vinyl, but in certain instances where export demands a low price the makers are using polystyrene, although with this material they do find that the edges have to be sharpened at intervals. Cellulose acetate, due to its relative softness, has not proved suitable for such scissors.

Powder Compact

The compact illustrated is made from brass with a scratchbrush finish, machine-cut "Perspex" being used as embellishment at the sides where the lid falls into position when closed. The "Perspex" is used in colourless quality or dyed in a range of colours. The compact is supplied by Fred Rees and Co., 4, Golden Square, London, W.1, who will shortly be using light metal alloys in place of brass for the metal parts.

Cigarette Lighter

The cigarette lighter shown has been sent to us by Mr. E. Ellis, of the firm of "Plasti-kraft," Waverley Works, Waverley Avenue, near Chesterton, Bicester, Oxon. Much of the attraction of this unit lies in the fact that it is of "Perspex" (the sample shown is black and white) and therefore light—no small point. Our own approval for it is based on the fact that it is such an excellent precision engineering job, with metal used in the correct places. The thick "Perspex" plate is also most appropriate, in addition to being so decorative, because of its strength and complete resistance to lighter fuels.

P.V.C. as Rail Covering

Over seven miles of extruded plastic ("Tenatube") has been used in the covering of many rails and rods in the R.M.S. "Queen Mary" while refitting the ship for the Atlantic luxury service. In all cases the tubing used has been of polyvinyl chloride, and the extrusions were made at the works of Tenaplas, Ltd., Upper Basildon, Berks. The colour used is mainly white, but the sizes vary considerably, according to the items to be covered, of which the most important are storm rails, curtain rods, trunk rails, tie rails, dress rods, shoe rods and hanging rods. Used in these situations, p.v.c. is attractive and keeps itself clean.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 587,797. Application date: 17.11.44. Convention date (U.S.A.): 2.10.43. Accepted: 6.5.47.

Improvement in Process for Insolubilising Vinyl Resins. G. M. Powell and E. F. Carlston. To: Carbide and Carbon Chemicals Corp.

B.P. 587,804. Application date: 5.1.45. Accepted: 6.5.47.

Polymerisation of Chloroprene. F. N. Wilder. To: E. I. Du Pont de Nemours and Co.

Refers to a method of regulating and accelerating the polymerisation of Chloroprene by regulating or adjusting the extent of contact of the polymerising system with oxygen.

B.P. 587,829. Application date: 19.1.45. Convention date (U.S.A.): 11.2.44. Accepted: 7.5.47.

Improvements in and relating to Plasticised Compositions derived from Resinous Polymers. F. W. Duggan and W. F. Hemperly. To: Carbide and Carbon Chemicals Corp.

Flame-proof vinyl copolymer composition containing a plasticiser (di-2-ethylhexyl phthalate) and antimony oxide.

B.P. 587,831. Application date: 19.1.45. Accepted: 7.5.47.

Improvements relating to the Manufacture of Phenolic Resins suitable as Exchange Materials. T. R. E. Kressman and D. A. Fraser. To: Ocean Salts (Products), Ltd.

Manufacture of monohydric phenolic resins by first partially condensing a monohydric phenol with an aldehyde or ketone and subsequently sulphonating the condensed product, afterwards reacting the sulphonated product with a further quantity of aldehyde or ketone until a water-insoluble gel is formed.

B.P. 587,833. Application date: 19.1.45. Accepted: 7.5.47.

An Improved Manufacture of Light Weight Resinous Insulating and like Materials. E. H. G. Sargent.

B.P. 587,844. Application date: 22.1.45. Accepted: 7.5.47.

Improvements in or relating to Flexible Sheet Material comprising Coated Fabric. A. Duerden. To: Imperial Chemical Industries, Ltd.

Fabric coated with a copolymer of butadiene and acrylonitrile containing gelatinised nitrocellulose. Such coated fabrics are used in the manufacture of fuel containers.

B.P. 587,877. Application date: 26.3.41. Accepted: 8.5.47.

A Method of Utilisation of Activated Sewage Sludge as Raw Stuff for Plastics. S. N. Stroganov.

B.P. 587,880. Application date: 10.5.43. Accepted: 8.5.47.

Improvements in or relating to the Production of Synthetic Resins. J. J. P. Staudinger, B. K. Kelly and C. A. Brighton. To: The Distillers Co., Ltd.

Emulsion polymerisation of halogen substituted ethenoid compounds employing a polymer of ethylene oxide as a protective colloid and crotonyl peroxide as a catalyst.

B.P. 587,899. Application date: 30.8.44. Convention date (U.S.A.): 24.12.43. Accepted: 8.5.47.

Improvements in Protective Coatings for Plastic Glass. To: United States Rubber Co.

Readily peelable, temporary protective covering, consisting of a polyvinyl acetal composition containing castor oil.

B.P. 587,914. Application date: 20.11.44. Convention date (U.S.A.): 16.11.43. Accepted: 8.5.47.

Production of Phenolic Resins. R. R. Whetstone. To: Shell Development Company.

Production of cured or infusibilised resins by partially condensing a phenol with formaldehyde and completing the condensation by heating after adding 3, 5-xylenol to the partial condensation product.

B.P. 587,977. Application date: 18.1.44. Accepted: 12.5.47.

Improvements in or relating to the Production of Polymeric Materials. To: Standard Oil Development Co.

Refers to the production of low-temperature olefinic polymers and to

methods for their recovery from solutions; also to the removal of the polymerisation catalyst.

B.P. 588,029. Application date: 1.3.44. Convention date (U.S.A.): 18.9.43. Accepted: 13.5.47.

Film. To: Wingfoot Corporation.

Moisture-resistant wrapping material consisting of rubber hydrochloride and a benzene soluble copolymer of vinyl chloride and vinylidene chloride.

B.P. 588,041. Application date: 1.9.44. Accepted: 13.5.47.

Improvements in or relating to the Polymerization of Ethenoid Compounds. J. J. P. Staudinger and D. Cleverdon. To: The Distillers Co., Ltd.

B.P. 588,058. Application date: 15.1.45. Convention date (U.S.A.): 28.8.44. Accepted: 13.5.47.

Stabilization of Vinyl Resins. To: Wingfoot Corp.

Stabilization of polyvinyl chloride and its copolymers with 0.5-10 per cent. zinc stearate and 0.5-10 per cent. of an alkali metal or alkaline earth metal stearate.

B.P. 588,143. Application date: 18.7.44. Convention date (U.S.A.): 22.7.43. Accepted: 15.5.47.

Improvement in Polymerization of Ethylene. C. O. Strother. To: Carbide and Carbon Chemicals Corporation.

Polymerization of ethylene containing not more than 0.01 per cent. by weight of oxygen at such a rate that at least 4 per cent. but not more than 20 per cent. of the ethylene is converted into solid polythene in a single pass. Polythene so prepared has no melting point but a softening range between 150-200 degrees C., is insoluble in any known solvent, and has better electrical properties than types prepared under usual conditions.

B.P. 588,273. Application date: 21.12.44. Convention date (U.S.A.): 30.12.43. Accepted: 19.5.47.

Improvements in or relating to Process and Apparatus for Thermoplastic Injection Moulding. To: Bakelite, Ltd.

Injection moulding machine which incorporates high-frequency heating equipment in the injection cylinder.

B.P. 588,329. Application date: 9.2.45. Convention date (Switzerland): 3.11.43. Accepted: 20.5.47.

Process for the Manufacture of Artificial Filaments or Yarns Resembling Wool. To: Heberlein and Co. A.G.

Treatment of highly twisted polyamide fibres by subjecting them to a treatment with an organic swelling agent which temporarily converts the individual filaments into a highly plastic condition. The swelling agent is subsequently removed from the yarn whilst it is still in the highly twisted condition, and the yarn is then back-twisted to or beyond the zero point.

B.P. 588,411. Application date: 16.2.45. Accepted: 21.5.47.

Improvements in or relating to the Production of Filaments, Fibres, and other Shaped Articles or Forms from highly polymeric Materials. E. G. Edwards and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

Process for the production of filaments, fibres, shaped articles, etc., from melts of highly polymeric linear polyesters obtained from aromatic dicarboxylic acid and glycols.

B.P. 588,425. Application date: 19.2.45. Convention date (U.S.A.): 18.2.44. Accepted: 21.5.47.

Improvements in or relating to Coating Compositions and to Fabrics Coated therewith. To: Imperial Chemical Industries, Ltd.

Coating composition consisting of an alkyd resin, a polyvinyl acetal resin and a monohydric alcohol modified urea formaldehyde resin.

B.P. 588,426. Application date: 19.2.45. Accepted: 21.5.47.

Process for the Production of Improved Heat Curable Materials. To: Imperial Chemical Industries, Ltd.

Improvement in the production of heat curable thermoplastic sheets comprising the calendering of a sheet at temperatures not exceeding 100 per cent. C. The sheet contains a monohydric alcohol-modified urea formaldehyde or athiourea formaldehyde resin and a hydroxy-containing polymeric material having a hydroxyl number of less than 275.

B.P. 588,435. Application date: 26.1.44. Accepted: 22.5.47.

Improvements in or relating to Sheet Materials comprising Polyvinyl Chloride Compositions. M. H. Brown. To: Imperial Chemical Industries, Ltd.

Improved process for the manufacture of sheet material which consists of gelatinized

polyvinyl chloride attached to a substrat (woven cotton fabric or paper).

B.P. 588,475. Application date: 21.2.45. Convention date (U.S.A.): 22.2.44. Accepted: 22.5.47.

Process for the Production of New and Useful Polymeric Materials. To: E. I. Du Pont de Nemours and Co.

Polymers produced by reacting acrylonitrile with a linear polymeric ketone (olefine/carbon monoxide interpolymer) in the presence of an alkaline-condensing agent (trimethylbenzyl ammonium hydroxide).

B.P. 588,497. Application date: 23.2.45. Accepted: 22.5.47.

Manufacture of new Highly Polymeric Linear Esters and the Production of Filaments, Fibres, and the like therefrom. J. G. Cook, J. T. Dickson, and H. P. W. Huggill. To: Imperial Chemical Industries, Ltd.

B.P. 588,500. Application date: 5.2.45. Accepted: 27.5.47.

Improvements in Machines for Calendering and like Purposes. A. Sadger.

B.P. 588,503. Application date: 23.2.45. Convention date (U.S.A.): 25.2.44. Accepted: 27.5.47.

Improvements in or relating to Dispersions of Synthetic Elastomers. To: Imperial Chemical Industries, Ltd.

Refers to a process for the reduction of the pH of an alkaline latex of synthetic elastomers (polychloroprene) by adding glycine to such latex.

B.P. 588,504. Application date: 23.2.45. Convention date (U.S.A.): 23.2.44. Accepted: 27.5.47.

A Process for the Production of new and useful Derivatives of Polyvinyl Alcohols. To: Imperial Chemical Industries, Ltd.

Esterification of polyvinyl alcohol or polyvinyl alcohol derivatives with a mercapto carboxylic acid (mercapto acetic acid). The product so obtained is then subjected to oxidation and moderate heat to make it partly or completely insoluble in water or organic solvents.

B.P. 588,531. Application date: 27.2.45. Accepted: 27.5.47.

Improvements in or relating to the Manufacture of Plastic Films. E. Schaefer. To: Erinoid, Ltd.

Manufacture of polystyrene films by casting from a solution. The casting solution may contain a mineral filler having a high dielectric constant in order to increase the dielectric constant of the film.

B.P. 588,549. Application date: 2.3.45. Convention date (U.S.A.): 3.4.44. Accepted: 27.5.47.

Surface Curing of Amine Modified Alkyd Resins. W. C. Norris and F. R. Spencer. To: American Cyanamid Co.

B.P. 588,567. Application date 17.10.44. Accepted: 28.5.47.

Improvements in or relating to the Method of making Cellulose Film Bags. J. Slater. To: Smith Brothers (Whitehaven), Ltd.

Attachments to machines for forming bags with serrated edges.

B.P. 588,574. Application date: 19.12.44. Convention date (U.S.A.): 12.4.44. Accepted: 28.5.47.

Improvements in Rubber and Synthetic Rubber Compositions. To: The Resinous Products and Chemical Co.

Plasticising of natural or synthetic rubbers by incorporating a linear polyester of 1,2-propylene glycol and sebacic acid.

B.P. 588,579. Application date: 22.1.45. Accepted: 28.5.47.

Improvements in or relating to Methods of Decorating and/or Inscribing Plastic Materials. T. W. Collier.

B.P. 588,590. Application date: 1.3.45. Convention date (U.S.A.): 1.3.44. Accepted: 28.5.47.

The Preparation of Articles consisting essentially of a Polymer of Tetrafluoroethylene. To: Imperial Chemical Industries, Ltd.

Manufacture of tetrafluoroethylene sheets by forming a slurry of the finely divided polymer in a liquid dispersant, removing the supernatant liquid after sedimentation of the polymer, volatilizing the remainder of the dispersant and subsequent sintering at a temperature exceeding 327 degrees C.

B.P. 588,609. Application date: 4.7.44. Convention date (U.S.A.): 21.5.43. Accepted: 29.5.47.

Improvements in and relating to Methods of indirectly Heating Non-conductive Materials by Electro-magnetic Induction. To: Induction Heating Corp.

A composition, comprising a thermosetting or polymerizable material and finely divided magnetic particles with a Curie point below the decomposition point of the binder, is set by induction heating.

"Heusler Alloy" powders are especially suitable for this purpose.

B.P. 588,617. Application date: 30.8.44. Accepted: 29.5.47.

Improvements in Apparatus for Producing Cellular Material. J. C. Quayle, P. Jones and E. W. Mills. To British Insulated Cables, Ltd.

Continuous production of cellular thermoplastic or thermosetting materials by high frequency heating of the plastic material which forms a travelling conveyor belt or is placed on such a conveyor belt.

B.P. 588,635. Application date: 31.1.45. Accepted: 29.5.47.

Improvements relating to the Manufacture of Moulded Articles from Moulding Powders. H. A. M. Winter. To: Hornflowa, Ltd.

Moulding of articles with differently coloured zones.

B.P. 588,648. Application date: 2.3.45. Convention date (U.S.A.): 2.3.44. Accepted: 29.5.47.

Process for Moulding Polytetrafluoroethylene. To: Imperial Chemical Industries, Ltd.

B.P. 588,660. Application date: 9.6.44. Accepted: 30.5.47.

Improvements in the Production of Polymeric Materials. F. J. H. Mackareth. To: Imperial Chemical Industries, Ltd.

Polymeric materials prepared by reacting an allyl or an alkyl substituted allyl ester of an aliphatic hydroxy-carboxylic acid, with phosgene or an acid chloride or an anhydride of a dicarboxylic acid with not more than six carbon atoms.

B.P. 588,697. Application date: 5.3.45. Convention date (U.S.A.): 6.3.44. Accepted: 30.5.47.

New and Improved process for the Production of Shaped Articles from Polymers and Copolymers of Tetrafluoroethylene. To: E. I. Du Pont de Nemours and Co.

Forming of articles by mixing the comminated polymer with an organic heat decomposable film-forming material, forming the mixture into the desired shape, heating until the film-forming material is decomposed and further heating until the polymer coalesces.

B.P. 588,725. Application date: 15.11.44. Convention date (U.S.A.): 16.11.43. Accepted: 2.6.47.

Process for the Production of Polymeric Materials. To: E. I. Du Pont de Nemours and Co.

Refers to interpolymers of styrene and maleic acid and their derivatives.

B.P. 588,742. Application date: 2.2.45. Convention date (U.S.A.): 4.2.44. Accepted: 2.6.47.

The Preparation of Modified Polymeric Substances. To: E. I. Du Pont de Nemours and Co.

Production of modified polymers from hydrolysed interpolymers of ethylene and vinyl esters.

B.P. 588,751. Application date: 9.3.45 and 23.11.45. Accepted: 2.6.47.

Improvements in and relating to the Production of Cellulose Ethers. J. H. McGregor. To: Courtaulds, Ltd.

Manufacture of cyanoethyl ethers of cellulose by reacting viscose with acrylonitrile at a temperature below 40 degrees C.

B.P. 588,833. Application date: 21.8.44. Convention date (U.S.A.): 15.10.43. Accepted: 4.6.47.

Preparation of Linear Polyesters. To: The Resinous Products and Chemical Co.

Formation of linear polyesters of high molecular weight from succinic or sebacic acid and an alkylene glycol in the presence of triphenylphosphite.

B.P. 588,849. Application date: 3.1.45. Accepted: 4.6.47.

Improvements in or relating to Polymethyl Methacrylate Compositions. J. C. Dunlop. To: The Bermondsey Leather Co., Ltd.

Utilization of polymethyl methacrylate scrap. Such scrap is reduced to a fine powder, then mixed with a suitable solvent and plasticizer. Subsequently fillers (pulverized leather, cork shavings, wood flour, soot, etc.) are added and the entire composition mixed thoroughly until a dough suitable for moulding or rolling is obtained.

B.P. 588,888. Application date: 9.3.45. Convention date (France): 30.7.43. Accepted: 5.6.47.

Solvents and Plasticizers for Polyvinyl Chloride Resins. J. Delorme and R. Bluma. To: Société Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauney et Cirey.

Refers to the use of benzaldehyde as a plasticizer or solvent for polyvinylchloride.

The Microscopic Examination of Plastic Materials

VI.—Mouldings (Fillers)—(f) Fibrous Materials (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

CONTINUING our discussion on the structure of the cellulose wall and the effects of solvents on this structure, it must be stated that much work has been carried out on the effects of various liquids on the cell wall, and in particular the swelling of wood tracheids by morpholine and pyridine has been well known for some considerable time, and has been made use of in the improvement of wood by impregnation with thermo-setting resins; thus the structure of the wood is opened up by treatment with a swelling agent prior to impregnation.

The effect of this type of agent and the mechanism of swelling has been studied by X-ray diffraction methods and micro-radiography, an excellent account of which is given in a paper by Clark and Howsman*. These authors came to the conclusion that although the swelling agent opened up the micellar structure of the cellulose wall, there was no evidence of a formation of a compound between the agent and the cellulose molecule; rather was the swelling accomplished by a penetration of the wall structure by the swelling agent; in consequence of this the swelling brought about by morpholine and pyridine was classed as inter-micellar as against intra-micellar, where compound formation exists. This conclusion was arrived at as a result of the lattice dimension of the treated and untreated cellulose remaining substantially the same.

The efficiency of impregnation obtained with alcohol-soluble and water-soluble resins on swollen and untreated samples showed that after pre-treatment with morphine, alcohol-soluble resins were more evenly distributed on the cell walls than was the case with the water-soluble resins. These conclusions are interesting, inasmuch as there would appear to exist a possible method by means of which a filler such as wood flour or finely cut-up fibres might be subjected to pre-treatment with an alcohol-soluble resin, so that each filler particle is already impregnated with resin before being incorporated into the moulding powder proper; in fact, there appear to be distinct possibilities of producing an efficient moulding powder by a modification of the old solvent process. This point has, however, been discussed previously and does not warrant further enlargement. There is a certain amount of justification for mentioning it in passing, in view of the importance of obtaining complete impregnation of the filler particles at an early stage in the proceedings and not relying on "brute force" in the mould to accomplish that which may be achieved more easily and with greater certainty by other means.

We have so far examined three of the strongest and most widely used commercial fibres and, without going into any very great detail, it is proposed to examine a few of the other types so that a broad outline of the latent possibilities in fibres in general may be obtained.

A large portion of commercial fibres are used in the paper industry; these are chiefly obtained from three sources, viz., wood (which does not concern us here), the fibre grasses, and the dicot fibres from groups already examined. We have not so far examined the grass fibres, so let us

* G. L. Clark and J. H. Howsman, Ind. Eng. Chem., 1946/38/1257.

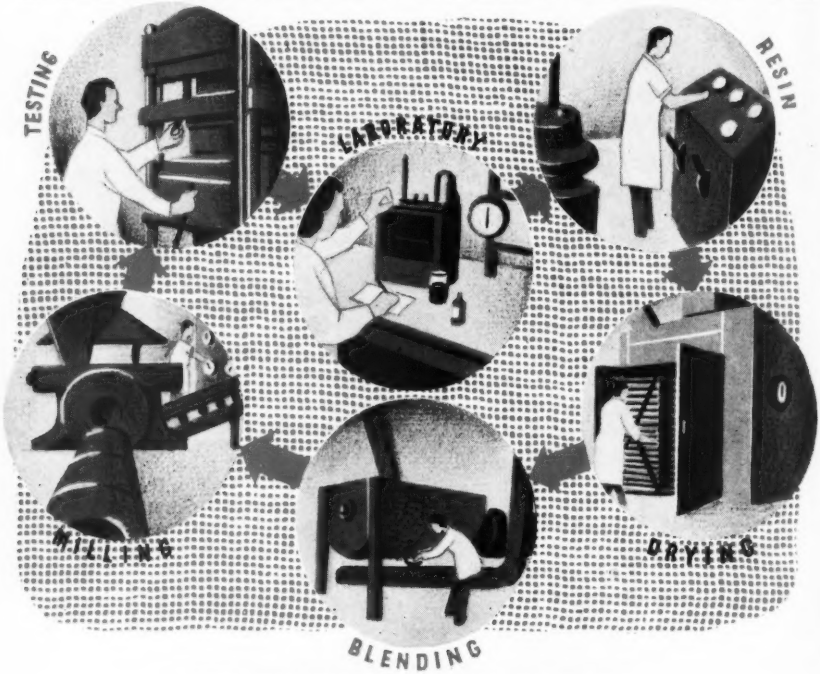
But there are limitations on what any one Plastic will do. Thus, before deciding what Plastic can solve their particular problem, wise manufacturers consult the 'Celanese' technical staff. Their experience, kept keen by continuous research and experiment, is freely given.

'Celanese' TRADE MARK Plastics

'Celanese' plastics are marketed under various trade marks including the following **'CELASTOID'** (Sheets, Rods, Tubes, Sections, Moulding Powders), **'CLARIFOIL'** (Film), **'CINEMOID'** (Special non-flam Sheeting).

BRITISH CELANESE LTD., Celanese House, Hanover Sq., London, W.1

YOU ARE RIGHT WITH NESTORITE



OUR WORKS DIRECTOR EXPLAINS

The specialised production of NESTORITE Moulding Powders is very similar in principle to an Inner Circle Tube Train, which returns to the station it started from.

NESTORITE starts at the Ferguson Laboratory on its journey through the Works, and after passing many process "stations," returns again to the Laboratory for final check-over and "pass out," before being switched over to "main-line" service to customers.

As Works Director, I have to supervise every stage of the "journey"—from initial tests of raw materials—their mixing, blending and colouring, and to ensure that the finished powder passes final laboratory tests before dispatch.

It is the efficient working of the "Inner Circle" in Ferguson manufacture that ensures ever-widening "Outer Circles" of Nestorite customers the world over.

JAMES FERGUSON & SONS LTD

TELEPHONE: MITCHAM 2283-7

MERTON ABBEY · LONDON, S.W.19

JOSE DELCLOS, Gignas, 39 Barcelona (2), Spain.

EINAR HOLMARK, 19, Gl. Kongevel, Copenhagen V., Denmark.

A. S. HARRISON & Co., Pty. Ltd., 85, Clarence Street, Sydney, Australia.

ANDRE BERJONNEAU, Boulevard des Batignolles, 33 Paris (Ville), France.

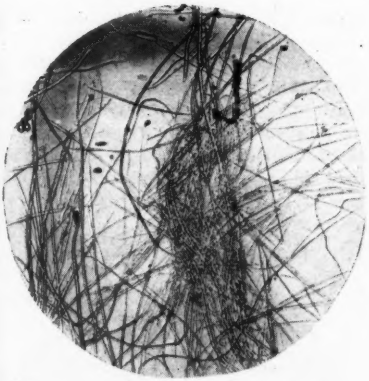


Fig. 209.—Esparto-grass fibres (felted). Mag. 20 diameters.

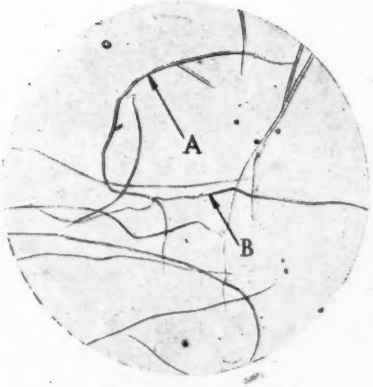


Fig. 210.—Esparto-grass fibres. Mag. 20 diameters.

look at esparto grass as being a typical representative of this type of fibre.

Esparto is a monocotyledenous type, and as such, the fibre obtained from the plant originates from the leaves and consists mainly of the phloem portion of the vascular bundles. The fibre as encountered in commerce is clean and consists almost entirely of individual phloem tracheids which are from 1.5-1.9 mm. in length and vary from 9 to 15μ in diameter. The length of the raw fibre prior to breaking down is some 10 to 40 cm. From this it will be seen that the average L.B. ratio for the fibre elements is approximately 14 : 1 with a variability ratio of about 2 : 1, so that this material in itself would be capable of functioning as an efficient filler. It must, however, be borne in mind that in this condition the material has been subjected to the breaking-down treatment resulting in the extraction of the ligneous matter, thus leaving almost pure cellulose, in consequence of which the strength of the elements may be expected to suffer. Furthermore, as the material is more in the nature of a flock rather than a flour, the difficulties attendant on its incorporation into a moulding powder need no emphasis, although it could conceivably be used in the same way as cotton flock.

In spite of this, however, it is worth examining, because of the possibility of producing a filler from it by the previously discussed method of cutting it up into short lengths. In Fig. 209 we see a mass of these esparto-grass fibre elements at a magnification of 20 diameters, which shows the elements to be very fine when compared with those of the coarser fibres. The material will be seen to be generally clean, and it will be noticed how the fibres tend to bunch together. This, of course, is the well-known felting tendency which makes them so valuable as a paper-making material, and in consequence of which this particular fibre, in this form, would appear to offer distinct possibilities for use in the felt preform moulding technique, which is becoming so popular these days.

Further, although this illustration shows very well the felting properties of the fibre elements, it is somewhat difficult to obtain a general idea of their morphology; however, this is obtainable by reference to Fig. 210, which shows a few of the fibres at the same magnification of 20 diameters and from which it can be seen that they are indeed complete phloem tracheids. The effect of removing the initial lignification, such as it is, is seen in the manner in which the flexibility is demonstrated by the element being flaccid and limp. The fibre marked A which,

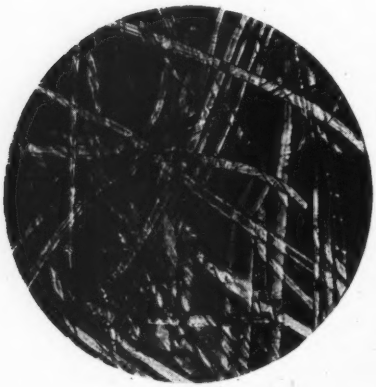


Fig. 211.—Esparto-grass fibres (felted) viewed under polarized light, system crossed. Mag. 95 diameters.

incidentally, is one of the longest, is seen to be much bent, as also is that marked B; from this their strong felting tendencies can be readily understood.

The density of the felted mass is well shown in Fig. 211, illustrating felted elements photographed under polarized light with the system crossed and at a magnification of 95 diameters. The manner in which the elements are interlaced with one another is clearly visible, the whole mass forming a dense network of fibres which can be separated only with difficulty.

A number of fibres will be seen to exhibit transverse markings which appear to be very similar to those previously encountered, and in the majority of cases the bore, or lumen, is barely distinguishable, all of which warrants a closer examination of the elements. Fig. 212 shows a single element at 150 diameters;

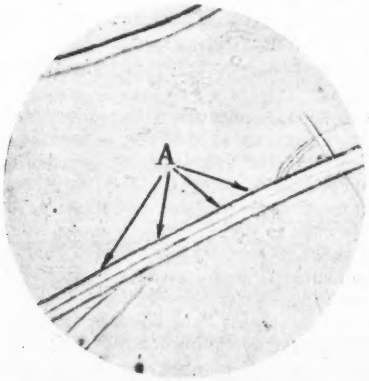


Fig. 212. — Esparto-grass fibre. Mag. 150 diameters.

Fig. 213.—Esparto-grass fibres varied under polarized light. Mag. 95 diameters.

here we see the lumen to be no more than a mere line. This condition is more or less characteristic of esparto, due to the tracheid wall being very thick and the element almost circular in cross-section. At the points marked A will be seen evidence of cross-markings very much like those seen in hemp, but viewed by transmitted light they are not very easily distinguishable, but become easily visible when viewed under polarized light with the system crossed, as seen in Fig. 213 at a magnification of 95 diameters. In this instance there is no need to annotate the illustration as the markings are self-evident, the outstanding feature of this being the great frequency with which the markings occur.

In the specimens illustrated, the average distance between markings is of the order of 50μ. If we assume that the existence

of these marks is due to a lignification pattern laid down, then their frequency is easily accounted for. Except for the fact that they appear to be "bunched" together at intervals, their general form tends to suggest a spiral lignification; but, on the other hand, it has been established beyond reasonable doubt that the development of these elements takes place in a periodic manner, stages of growth and no-growth alternating with one another. Therefore it would appear likely that the "bunching" of the markings occurs during the no-growth periods.

If is very difficult to find any evidence of a spiral micellar structure, in this fibre, of a similar nature to that encountered heretofore, but there is abundant evidence of the now-familiar so-called "pinches" in the surface layer of the cellulosic wall. These are similar to those previously described, with one important exception, this being their orientation with respect to the fibre axis. In the case of the esparto figure under consideration, these pinches are seen to be parallel to the fibre axis, as shown in Fig. 214, this being a photomicrograph of the upper surface of an element at a magnification of 840 diameters, and in which we see two typical pinches in the upper surface of the element lying in the aforementioned direction. This structure will, of course, have its effect on the strength of the fibre, which latter is not as great as that for hemp; nevertheless, the strength of the fibre is such as to make it very useful for papermaking, etc., and on this account it should not be overlooked in so far as the possibility of using it as a filler is concerned. The apparently parallel micellar arrangement helps in the examination of the wall structure of this fibre, and certainly enables us to see the layers composing the wall when looked at from this side. Thus, at B will be seen some of the outermost layers of the cell wall as seen in longitudinal optical section (the extent of the lumen being shown at C), and from which we see that each layer is approximately 0.5μ thick.

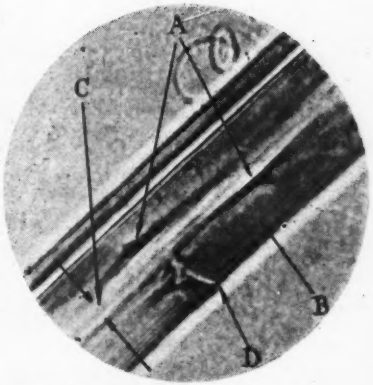


Fig. 214. — Esparto-grass fibre element showing surface "pinches." Mag. 840 diameters.

This structure would offer an explanation in part of the ability of these fibres to withstand a considerable amount of bending without suffering any great degree of mechanical damage, for if we examine the changes which occur around a sharp bend in an element such as this it will be seen that, where the stresses are greatest, i.e., on the outer layers, full advantage can be taken of any inherent elasticity in the layers if (and there does not appear to be any evidence to the contrary) the micellar layers are free to slide over one another. In this way it would be possible to produce an overall elasticity which is equal to, and in all probability greater than, that of cellulose itself. At the same time, the buckling of the inner wall will be accomplished with the minimum amount of permanent damage; it should, however, be realized that, whereas this arrangement of structure could conceivably result in a high degree of flexibility (particularly in the living plant, where the natural fluids would function as an efficient lubricant), there must exist a limit beyond which the structure breaks down and the fibre ruptures. It will also be noted that in those cases where the micellar layers are spirally orientated, further increase in flexibility may be obtained due to an

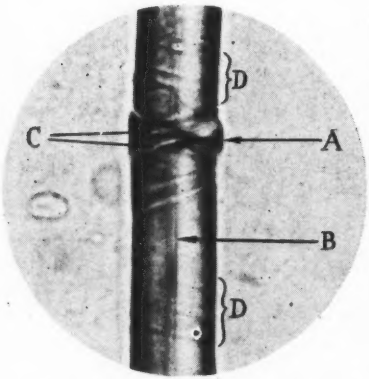


Fig. 215. — Esparto-grass fibre element showing cross marking, viewed under polarized light, system crossed. Mag. 840 diameters.

increase in the elasticity of the individual layers resulting from the spiral structure.

At D (Fig. 214) we see an irregularity in the surface of the element, produced by one of the so-called cross-markings in embryo. It will be noticed that it forms a definite ridge on the surface of the cell wall amounting to a modification of the physical dimension of the cell wall. We have seen that this occurs in those cases where thickening has taken place due to lignification of the tracheid or element; it would, therefore, appear to be probable that, in the case of the esparto-grass fibre element, some such thickening occurs, for the fibre shows signs of slight lignification, and it is reasonable to suppose that when this takes place a patterned thickening of the cell wall may occur.

In this instance, however, we cannot be absolutely certain that the ridge is a part of a cross-marking, as it might just as well be a deformity of the cell wall brought about by interference from adjacent elements during its development, so suppose we examine a well-developed marking of the identity of which there is no doubt. One such is illustrated in Fig. 215, which shows one of these markings at a magnification of 840 diameters.

It would, perhaps, be as well to digress for a moment to explain that the clarity with which the element and its markings may be seen is due to the use of polarized light, but in contradistinction to the previous illustrations, in which this method has been used with a crossed system, the polarizing system in this case was left open, with the result that the fibre appears dark on a light background. The use of polarized light was very necessary, as with ordinary transmitted light the specimen was so transparent as to be almost invisible.

However, to return to our subject, the strongest portion of the marking is seen at A (while the narrow lumen of the element is shown at B), where the element has developed a considerable thickening of the cell wall, which, if examined carefully, is seen to be composed of several narrow bands or coils squeezed up together, two of which are shown at C. The net result of this seems to be a fusing of the bands, resulting in the solid thickening indicated at A. The modification of the cell wall, however, is not localized in this thickened portion, as can be gathered from the evidence of open-spiral thickenings at the points marked D, which would seem to point to a general structure consisting of spiral lignification, which, for some reason or other, becomes locally concentrated at points along the length of the element. Whether this is due to periods of arrested growth or to other mechanical forces coming into play has not yet been fully established. The only conclusion which may be arrived at with reasonable certainty is that there are different originating causes for these cross-markings, which appear so similar in different fibres and yet when looked into carefully show differences of structure, indicating that they are either of differing nature or origin.

Thus, the markings which appear in non-lignified and highly lignified fibres, although very similar to look at, could hardly be expected to originate from lignification in both cases. There must, therefore, exist some other agency which

This is the latest addition to our range of battery boxes. It is the 6 volt 11 plate low type which is now so popular. Four more new types are in preparation.

PRIORITY USE FOR TELENDURON

Only a box, but it houses the battery in your car, and where would you be without it? Only a box, but an important box, a box made from Telenduron, the bitumen asbestos moulding compound made by British Moulded Plastics. At a time when most things are scarce Telenduron is relatively plentiful. It is a versatile material—sturdy and durable. It may well be that this is the answer to your particular manufacturing problem.

A NATIONAL PLASTICS COMPANY

BRITISH MOULDED PLASTICS LTD.
AVENUE WORKS • WALTHAMSTOW AVENUE • LONDON • E 4

BM. 103

WHEN YOU MEAN BUSINESS

FLY BEA

Get to the point more quickly—by air. The services of BEA bring a personal touch into business relations with countries across the Channel and stimulate closer, more realistic contact between the manufacturer and his continental markets. Firms which speed their representatives, samples and tenders by air appreciate that time is money, and that flying saves both

Regular services between London and Amsterdam, Ankara, Athens, Berlin, Bordeaux, Brussels, Copenhagen, Frankfurt, Geneva, Gibraltar, Gothenburg, Hamburg, Helsinki, Istanbul, Lisbon, Madrid, Marseilles, Oslo, Paris, Prague, Rome, Stavanger, Stockholm and Vienna

BEA THE KEY TO EUROPE

British European Airways **Reservations and enquiries from principal travel agents and from Airways Terminal Telephone Victoria 2323 Headquarters Northolt Middlesex**

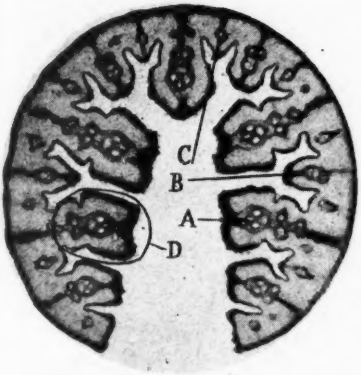


Fig. 216. — Esparto-grass (transverse section). Mag. 26 diameters.

is capable of modifying cellulose itself in this manner. It can, however, be assumed that, in general, these markings are a means by which a certain amount of extra strength is developed in the fibre by virtue of conferring increased elasticity, so in our search for those fibres most liable to show high-strength figures when used as fillers for moulding powders, it would seem desirable to choose those which show the strongest markings of this type.

As the esparto fibre shows these marks very strongly, it can be concluded, and rightly so, that it is a strong fibre generally. This latter is, of course, justified as the fibre is probably the strongest of its kind and in respect of which its utility in producing strong papers is too well known to need further emphasis. Likewise, as has been previously discussed, its strong felting properties make it most useful for felt preform moulding, anent which the felting properties are, in all probability, largely due to the presence of the thickened portions on the elements which would function in a similar manner to the scales on the wool fibre, tending to hold them together in a mass.

Structurally, the esparto-grass leaf, from which the fibre is prepared, is very interesting; therefore, it is proposed to examine this by way of interest, and also to see something of the living plant from which the commercial fibre is obtained. It is obviously not a practical proposition to do this with all the fibres, but it might be of some value in one or two cases and the esparto leaf affords a very good example of this, in that it is typical of its type. Thus, in Fig. 216 we see a transverse section of the esparto leaf at a magnification of 26 diameters, and from which it will readily be seen that the leaf has a rolled-up structure and exhibits typical monocot characteristics, being made up of a number of vascular bundles which may easily be grouped into three classes according to size. An example of the largest-sized bundle is shown at A, while one belonging to the medium-sized group is seen at B and, finally, a representative of the group comprising the smallest size being annotated at C.

One feature of this type of leaf is the orderly arrangement of the vascular bundles, which alternate with one another in annular size, the largest being on the inside. It will also be noticed how each type of vascular bundle gives rise to a prominence on the inner surface of the leaf, and that these prominences vary in size with the size of the vascular bundle creating them. Thus, the prominences due to the largest vascular bundles are of great size compared with those originated by the smallest bundles. This structure is most interesting, for it is not difficult to visualize how it may bring about easy decortication, so that in the case of the large bundles, such as that marked D, the entire prominence could be easily stripped from the leaf, as it is almost cut off in the natural state. In view of this, it is also reasonable to suppose that this would tend toward the production of a fibre carrying a great deal of extraneous matter; however, as the fibres are chiefly used in the mascerated form, this difficulty does not cause much trouble.

However, in view of the possible use of the cut whole fibre for fillers, it would, perhaps, be advisable to examine this section at somewhat closer quarters, so

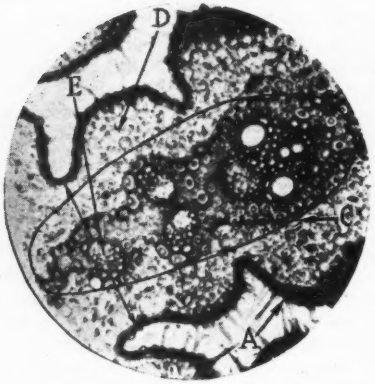


Fig. 217.—Esparto-grass (transverse section). Mag. 100 diameters.

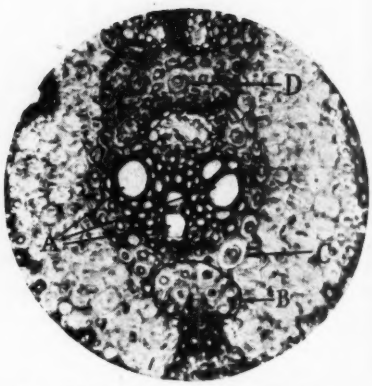
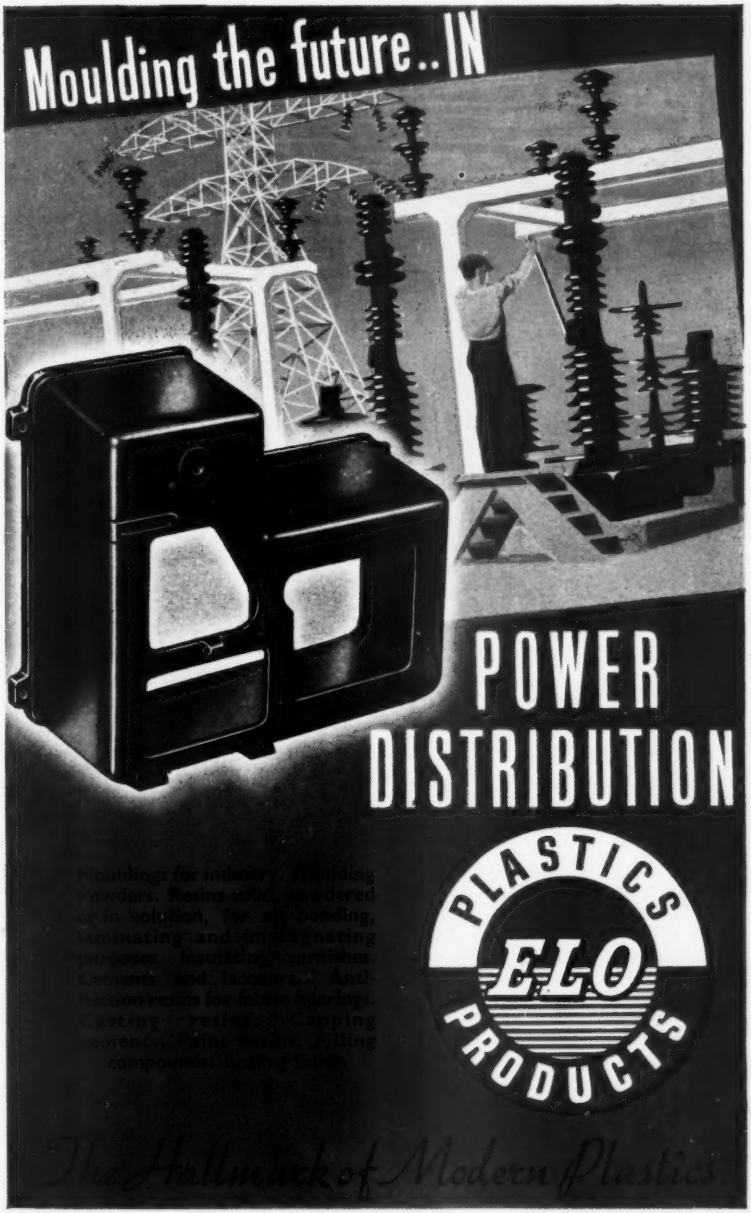


Fig. 218.—Esparto-grass (transverse section). Mag. 140 diameters.

that a better conception of the more detailed structure is obtained. In Fig. 217 we see illustrated one of the largest prominences at a magnification of 100 diameters. This photograph shows the general detailed structure quite clearly. The epidermal tissue, together with its hairs, can be easily distinguished as a dark band A, forming a peripheral layer to the prominences. This layer is composed of soft cells, and as such they are relatively easy to remove by the mascerating treatment. In the same way, the layer of soft, spongy tissue to be seen investing the vascular bundle marked C and annotated at D, is also capable of easy elimination.

As the portion which furnishes the fibre elements for papermaking consists of the entire vascular bundle, it will be seen from the foregoing that, if the raw fibre possesses any adherent soft tissues, then these will not cause much anxiety. When, however, the fibre is to be cut up into very short lengths for use as a filler, then the possible presence of an appreciable amount of the soft tissues must be taken into consideration. For the presence of this is rather to be expected in view of the distinct possibility of the entire vascular bundle, and its accompanying soft tissues, becoming detached from the leaf at its weakest point (which, at the same time, is its point of attachment shown at E) on attempting to strip the fibre mechanically.

On examining the vascular bundle itself at somewhat closer quarters, as shown in Fig. 218 at a magnification of 140 diameters, it is seen to exhibit the structure typical of monocot plants. That is to say, the bundle itself is isolated from its neighbours and consists of numerous small fibres making the bast tissue, embedded in which are the few xylem vessels; in this case there are three such vessels shown at A. These are thin-walled and highly lignified in the usual manner. The bast fibres, on the other hand, are seen to be possessed of thick walls and small bores, as expected from our examination of the fibre element exhibiting a very fine lumen (a representative group of this kind of fibre is shown at B), the most notable feature of these tissue elements being their remarkable regularity of physical dimensions and their profusion, although it will be noticed that, scattered here and there among the small fibres, are some with thinner walls and bores of greater diameter, such as that shown at C. However, these are few and far between and their presence may be ignored in so far as


Moulding the future..IN
POWER
DISTRIBUTION
Mouldings for Industry. Moulding Powders. Resins solid, powdered or in solution, for all bonding, laminating and impregnating purposes. Insulating varnishes. Cements and lacquers. Anti-friction resins for fabric bearings. Casting resins. Capping cements. Paint bases. Filling compounds. Sealing fluids.
PLASTICS
ELO
PRODUCTS
The Hallmark of Modern Plastics

BIRKBYS LTD., LIVERSEDGE, YORKSHIRE

m and i

THE MICANITE & INSULATORS COMPANY LTD.
Empire Works, Blackhorse Lane, Walthamstow, London, E.17

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS and TERMINALS. Distributors of Micoflex-Duratube sleevings.

any effect they are likely to have on the final characteristics of the product.

An interesting feature of this section is the manner in which the mechanical forces (or so it seems) occurring during development have distorted the cross-sections of the bast fibres surrounding the three main vessels; thus, those on the right-hand side of the vessels have become oval, whilst those on the left have developed a polygonal cross-section. The true circular cross-section is well shown by the fibre marked D, which is situated in the centre of a mass of phloem tissue and hence not likely to be greatly hindered during development by deforming stresses. As to whether those fibres on the outside exhibit the markings more than the inner, more protected, individuals has not, of course, been established.

From the foregoing it will be clear that in the esparto fibre we have a material which cannot be ignored in so far as its potentialities for use as a filler are concerned, for it has been shown that, apart from its usefulness as a filling fibre for felt preforms, it would also prove of some not inconsiderable utility as a powder-type filler when the whole fibre is reduced by cutting into very short lengths, which latter, if properly controlled, is capable of producing a powder with desirable characteristics respecting L.B. ratio and variability index and, as the lumen of the esparto fibre is generally of small dimensions and the wall is thicker than in most stem fibres, the thorough impregnation of such a filler may be expected to be accomplished with somewhat greater facility than in the case of those fibres possessing large bores and thin walls in the fibre elements. In any case, if the circumstances were such that the impregnation was lacking, then, owing to the small dimensions of the bore, the chances of the existence of large volumes of occluded air would be diminished.

However, as is the case with all commercial fibres, it must be remembered that, in comparison with fillers such as woodflour, the fillers are at the present time much too expensive a raw material for filler production, but it should also be remembered that in the commercial-fibre industries there occurs quantities of waste material containing a high percentage of fibre, which could be put to good use for filling moulding powders.

(To be continued.)

SPECIAL PROBLEMS OF HIGH-FREQUENCY WELDING OF VERY THIN PLASTIC SHEETS

(Continued from page 478)

outside of the sheets. The R.F. method, however, has the advantage that it is not necessary to rely on the thermal conductivity of the plastic to transfer the heat to the interface. The method would, therefore, still have some advantages over "heated tool welding."

Finally, it should be stated that practical experience with heat-insulated and preheated electrodes have largely confirmed the theoretical figures shown in this paper.

It will be realized that it is not very easy to measure accurately temperatures in thin sheets subjected to R.F. currents, but taking welding times and finish of welded seam (strength and external appearance) as a criterion, it can be said that practical tests have largely confirmed the findings which have been deduced on a purely theoretical basis.

GAUGE AND TOOL MAKERS' ASSOCIATION.—Following the success of the first Gauge and Tool Makers' Exhibition, held in London, in January, 1946, the Council of the Gauge and Tool Makers' Association has decided to arrange another Exhibition in January/February, 1948. On this occasion the Association has invited the National Federation of Engineers' Tool Manufacturers to co-operate. The Exhibition will be held at the Halls of the Royal Horticultural Society, Vincent Square, London, S.W., Monday, January 26, to Friday, February 6, inclusive.

PLASTICS IN GERMANY

(continued from page 488)

trifluoride dehydrate in dioxane. The solids have found application as thickeners, textile finishing agents, adhesives, plasticizers, and paints for masonry. The oils have been used rather extensively as shoe and leather impregnating agents. Waxes and resins, to date, have limited applicability.

FIAT Final Report, No. 870.—Operating data for the production of "Styroflex" film from polystyrol are given in this report. The principal novelty of the process lay in the orientation of polystyrene film and the mechanical method of accomplishing this. The oriented film is much more flexible than the usual films made from polystyrene. The orientation method is claimed to be ingenious, and if applied successfully to the other film-forming materials it should prove of definite interest to manufacturers of films from plastic materials. Oriented polystyrene films made in the manner described in the report are said to be expensive because the output per machine is small, and the rejects (particularly in thin film) are high. However, the importance of the film to the cable industry is such that these high costs can be absorbed. The development of Styroflex film started in 1934. Uses include cable and wire insulation, manufacture of condensers for radio receivers, and collapsible tubes.

Index to Advertisers

	Page
Albright-Wilson, Ltd.	xviii
Almex, Ltd.	lii
Bakelite, Ltd.	xxxii
Banarse, P. S., & Co. (Products), Ltd.	liii
Barber & Duffy, Ltd.	liv
Birkby's, Ltd.	xli
B.B. Chemical Co., Ltd.	xxx
British Celanese, Ltd.	xxxvii
British European Airways	xl
British Industrial Plastics, Ltd.	xliii
British Institute of Plastics Technology	xlvi
British Moulded Plastics, Ltd.	xxxix
British Resin & Products, Ltd.	iv
Bushing Co., Ltd., The	xx
Butcher, Henry, & Co.	lx
BX Plastics, Ltd.	Inside Front Cover
Byson Appliance Co., Ltd.	lx
Catalin, Ltd.	Inside Back Cover
Chamberlain & Willows	liv
Cohen, George, Sons & Co., Ltd.	ii
Coldwell, W. B., & Sons, Ltd.	lx
Cole, E. K., Ltd.	xix
Cole, R. H., & Co., Ltd.	Back Cover, xviii
Courtaulds, Ltd.	xlvi
Crompton Parkinson, Ltd.	viii
Crystalate, Ltd.	xi
Davis & Timmins, Ltd.	xlviii
Desouter Bros., Ltd.	xvii
Dohm, Ltd.	xx
Dominion Export Co., Ltd.	xlviii
Duraplex (Plastics), Ltd.	xxiv
Duratube & Wire, Ltd.	xxx
E.M.S.A., Ltd.	xliv
English Steel Corporation, Ltd.	xxvii
Erinoid, Ltd.	Front Cover
Evans, Frederick W., Ltd.	liv
Ferguson, James, & Sons, Ltd.	xxxviii
Fisher & Ludlow, Ltd.	lii
Flextol Eng. Co., Ltd.	xxvi
Galea, G.	xlviii
Gardner, Wm., & Sons (Gloucester), Ltd.	xxxvi
General Electric Co., Ltd., The	xxv
Goldberg, L., Ltd.	l
Gosheron, John, & Co., Ltd.	lv
G.R.L. Plastics, Ltd.	xlviii
Harris, Alfred	liv
Herbert, Alfred, Ltd.	xxiii
Holoplast, Ltd.	x
Imperial Chemical Industries, Ltd.	xxxv
Jones, E. H.	xxviii
Jones, Samuel, & Co., Ltd.	xlvii
Kent Mouldings	xxviii
Kenure, J. F., Ltd.	lv
Kodak, Ltd.	xvi
Lavino (London), Ltd.	xlv
Law, F. W., & Sons, Ltd.	lx
Light, H. A., Ltd.	lii
Low Temperature Carbonization	vii
McArd, Robert, & Co., Ltd.	xv
M.C.L. and Repetition, Ltd.	lx
M.C.M. (Tools), Ltd.	liv
Merchant, Peter, Ltd.	xxxi
Mica Products, Ltd.	lv
Micanite & Insulators Co., Ltd., The	xlii
Ministry of Fuel and Power	lvi
Ministry of Supply	xxvi
Monsanto Chemicals, Ltd.	xxxiii
Moulded Products, Ltd.	xii
National Savings	xlix
Newall-Sentinel, Ltd.	xliv
New Insulation Co., Ltd., The	ix
Office Appliance Trades Association	xvi
Page, W., & Sons	l
Peace, Harold E., & Co., Ltd.	xliv
Potts Engineers, Ltd.	xlv
Proved & Producing	liv
Rediffusion, Ltd.	iii
Reed Bros. (Engineering), Ltd.	xiii
Reliance Trading Co.	liv
Rootes Mouldings, Ltd.	xiv
Rubber Improvement, Ltd.	xxxiv
Sagar (Developments), Ltd.	v
Sellotape	liii
Shannon, Ltd., The	xlix
Steele & Cowlishaw, Ltd.	l
Sternol, Ltd.	li
Sunvic Controls, Ltd.	li
Synchronome Co., Ltd., The	xlvi
Tenaplas, Ltd.	i
Toolmakers & Designs (Coventry), Ltd.	l
Turner Mfg. Co., Ltd.	vi
Tyne Truck and Trolley Co., Ltd.	xlvi
United Ebonite & Lorival, Ltd.	xxix
United Plastics & Chemicals (London), Ltd.	xxii
Universal Tools, Ltd.	xxiv
Utilex, Ltd.	xlvii
Vinyl Products, Ltd.	lii
Wall Paper Mfrs., Ltd., The	

Leaves from a Moulder's Notebook

This is the tenth in a series of notes by the B.I.P. Development Department on the problems of the moulder and designer. B.I.P. will send a copy of previous notes on request and will welcome comments and enquiries.

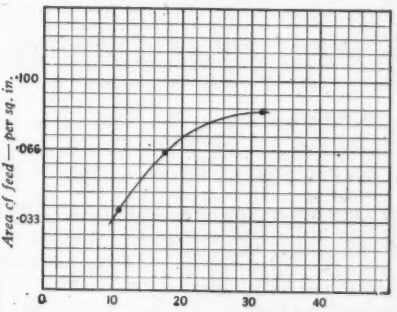
H.F. preheating with particular reference to transfer moulding.

H.F. preheating, commonly used and now fairly well understood in compression moulding, is employed to a lesser degree in transfer moulding. For one thing the proportionate improvements in cycle time are as a rule smaller than can be achieved in compression moulding. The function of H.F. preheating in compression moulding is to bring the material as closely as possible to a state of uniform plasticity before it is introduced into the mould form. In transfer moulding this is already more than half accomplished by the heat the material gains in the pot and in its passage through the feeds.

In the type of transfer mould with the minimum workable feed size the speed of flow (the fastest cycle element) will be at a maximum, whilst the time of cure (the slowest cycle element) will be at a minimum owing to the gain of frictional heat. The full advantage of H.F. preheating cannot be derived in such cases since the extra heat imparted to the material will tend to pre-cure it before flow is completed, although flow speed will be slightly improved.

By the application of only partial preheating slight improvement to the extent of 5-15 per cent. can be imparted to flow and cure times. If, however, the feed sizes are increased, this will give the advantage of faster feeding and will permit the H.F. preheating of the mass to be carried to a higher temperature. Under these conditions cycle time improvement has in practice been proved to be as much as 45 per cent. with the added advantage of lower injection pressures.

Improvement in cycle time with various areas of feed when using H.F. preheating.



Per cent. gain in time of cycle (flow + cure.)

B·I·P GROUP
BRITISH INDUSTRIAL PLASTICS LIMITED
1 ARGYLL STREET · LONDON · W1

MANUFACTURERS—

YOUR EXPORT POLICY IS WRONG..

***IF** Your products do not reach overseas markets at your factory prices—WITH NOTHING ADDED.*

***IF** YOUR OWN NAME is not being made known to potential buyers throughout the world.*

***IF** You are still worried with clerical and detail work, form filling, etc.*

E.M.S.A. is a new and revolutionary export service which, on a truly modest fee basis, sells YOUR products, under YOUR name at YOUR price, and does all your shipping on a non-profit basis. It has been organised to meet Britain's urgent export needs—send the coupon below for fully descriptive 16-page booklet.

EMSA

TAKES OVER YOUR EXPORT WORRIES—BUT TAKES NO PERCENTAGES.

The Export Manufacturers Service Association Ltd., 63, Coleman Street, London, E.C.2.

COUPON *Please send me a copy of the 16-page booklet describing the E.M.S.A. Service.*

Name.....

Address..... U

INFORMATION

about precision machine tools and instruments.

Please forward for my attention, as and when published, literature dealing with the Newall-Sentinel equipment, against which I have placed a tick.

Newall Jig Borers . . . . . —
Newall Thread Grinders in two sizes —
L A Cylindrical Grinders . . . . —
Keighley Types KL, KU, KN, and KS Grinders . . . . . —
Omtimeters (Vertical or Horizontal) —
Optical Circular or Inclinable Tables —
Toolmakers' Microscopes . . . . —
Sentinel Cridan Threading Machines —
F U Variable Speed Units . . . . —
Sentinel Lathes . . . . . —

Name.....

Status .....

Address.....

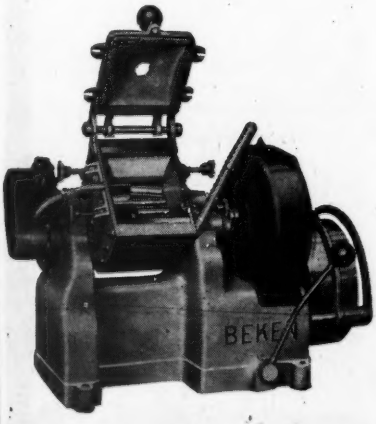
Post to:—
NEWALL-SENTINEL, LTD., SHREWSBURY

ENGINEERS TO THE PLASTIC INDUSTRY

POTTS

Are now in full production with SPECIALITY EQUIPMENT of all types and early deliveries can be quoted for the following: Die-casting Dies ★ Moulds for Plastic Materials ★ Steel Brands, Stamps, Nameplates, Metal Checks, Labels, etc. ★ Die-sinking and Engraving Work ★ Jigs and Fixtures ★ Special Machines, etc. *Whatever your problems we shall be able to help . . . just get in touch with* **POTTS ENGINEERS LTD.**

FIRTH TERRACE, NEWTOWN, LEEDS. *Telephone* 23522



BEKEN DUPLEX MIXERS

Superiority Analysed

One of the reasons why the BEKEN "Duplex" Mixer is so much more efficient is the design of the paddles. As will be seen from the illustration, mixing is done between the intermeshing blades and not between the blades and the pan. No other method of operation can secure such a homogeneous mix . . . and it is attained with the minimum time and at low power cost. There is a model to suit any size batches . . . write for illustrated catalogue.

Sole Distributors: LAVINO (LONDON) LTD. Tel:— Chancery 6137-8
103, KINGSWAY, LONDON, W.C.2.

Sole Makers: E. HUNT & CO., LTD.
RIPPLE ROAD, BARKING, ESSEX.

George Washington

COULD HAVE TOLD A LIE... if he had tried, but it is impossible for the Synchronome Electrical Impulse Clocks to do so.

They do not depend on the Electricity Supply for their timekeeping or for their continuity of operation. They are installed all over the world and the Master Clock embodies the fundamental principles of the Free Pendulum installed at Greenwich Observatory by the Synchronome Company which has held the world's timekeeping record since 1925.

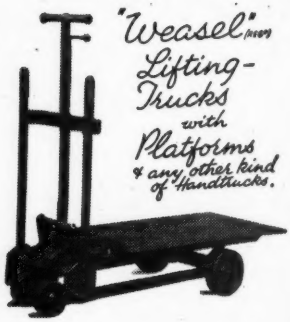
Supplied on rental terms including full maintenance or can be purchased outright. Write for full technical details of the SYNCHRONOME Clock and time recording systems for Factories, Offices, Public Institutions, Schools, etc.

but* SYNCHRONOME CLOCKS *cannot!

THE SYNCHRONOME CO., LTD.
ABBEY ELECTRIC CLOCK WORKS
WOODSIDE PLACE, MOUNT PLEASANT, ALPERTON, WEMBLEY.
Telephone: WEMbley 3643.

TYNE TRUCK & TROLLEY CO. LTD

66/68 NORTHUMBERLAND STREET NEWCASTLE UPON TYNE.1



"Weasel" and Lifting-Trucks with Platforms & any other kind of Handtrucks.

OPPORTUNITIES IN PLASTICS

A most informative handbook entitled **"OPPORTUNITIES IN PLASTICS"** is now available for distribution. This guide discusses in considerable detail the prospect of careers in all branches of the Plastics Industry—knowledge required, salaries, possibilities of promotion, and so on—and explains how you may prepare for these opportunities through our modern home-study courses.

We specialise in Plastics training and our courses are authoritative, up to date and comprehensive. The range of our tuition is wide, covering **Elementary Instruction in Basic Subjects**, **PLASTICS TECHNOLOGY**, coaching for the **CITY AND GUILDS EXAMINATIONS**, and specialised instruction in such specific branches of the industry as:—

Plastics Mould Design, Plastics in the Paint, Varnish and Lacquer Industries, Plastics Costing and Estimating, Plastics for the Aircraft Industry, Plastics for the Electrical Industry, Plastics for the Building Industry, Plastics in Sales Promotion, Plastics in Textiles, Designing in Plastics, Synthetic Rubber Technology, etc.

All courses are conducted under a guarantee of

"SATISFACTION OR REFUND OF FEE"

"OPPORTUNITIES IN PLASTICS" will be sent on request, free and without obligation. The book contains so much useful information and guidance that whatever your interest in plastics may be, you should make a point of writing for your copy at once.

BRITISH INSTITUTE OF PLASTICS TECHNOLOGY
2, Shakespeare House,
17, Stratford Place, London, W.1

Courtaulds LIMITED

MOULDING POWDERS

SHEETING

TUBING

FILM

MADE FROM

CELLULOSE ACETATE

Plastics Division
Foleshill Road, Coventry. *Telephone: Coventry 88771*

UTILEX

UTILEX
TRANSPARENT CELLULOSE ACETATE.
INSULATING.
LIGHT.
EXCEPTIONAL IN CLARITY.
EXCELLENT IN QUALITY

SHEETS, FILMS, MOULDING POWDER AND RIGID TRANSPARENT CONTAINERS.

UTILEX LIMITED,
MILL STREET,
KINGSTON-ON-THAMES.
Telephone: KINGSTON 1660.

Makers of Synthetic
RESIN PAPERS
(IMPREGNATED AND COATED)

for the MANUFACTURE of LAMINATED SHEETS and TUBES

CAMBERWELL BEAUTY
Regd Trade Mark

SAMUEL JONES & CO. LTD
16-17 NEW BRIDGE STREET. E.C.4. PHONE: CENTRAL 6500

Plastic Moulding Materials

FOR INJECTION & COMPRESSION MOULDING

PHENOL FORMALDEHYDE
UREA FORMALDEHYDE
MELAMINE FORMALDEHYDE

CELLULOSE ACETATE, BUTYRATE
ETHYL CELLULOSE, ACRYLICS
POLYSTYRENE, POLYETHYLENE

Virgin and First Grade Materials available for early delivery. Full specification and terms, etc., on application to:
MATERIAL DEPT.

DOMINION EXPORT CO. LIMITED
11, Oxford Circus Avenue, London, W.1
'Phone: Gerrard 2931 *'Grams: Stepla, London*

TURNED PARTS for

MOULDED ELECTRICAL PRODUCTS

DAVIS & TIMMINS LTD
Head Office: BILLET ROAD : WALTHAMSTOW
LONDON · E.17. · Tel. LARKSWOOD 2313 (6 LINES)

SUPPLIES FROM STOCK

CASEIN
SHEETS RODS TUBES
CATALIN CAST SYNTHETIC RESIN
SHEETS, RODS, TUBES, PROFILE SHAPES
P.V.C.
Sheeting 48" wide—6/8 thou thick
16" x 20"—30-35-40 thou thick
CELLULOSE ACETATE SHEET
from 0.05 to 7 m/m. thick,
Opaque and Transparent
"CRINOTHENE"
Acetate Sheets for Lampshades—
all colours
CELLULOID
"PERSPEX" BRAND ACRYLIC RESIN SHEETS
from 1/24" to 1" — Clear and Clouded
EBONITE
SHEETS RODS
MOULDING & INJECTION POWDERS
GILBERT GALEA
MERCHANT IMPORTER-EXPORTER
Established 1918
Dominion House, Bartholomew Close, London, E.C.1
Phone: MONarch 3994 & 6770
Grams: Gilgalbert, Cent, London

FINEST QUALITY
PLASTIC
P. V. C.
SHEETING
IN EVERY VARIETY OF COLOURS, INCLUDING METALLIC SHADES, TRANSLUCENT AND PRINTED SHEETS

GRL *plastics* **LIMITED**
58, FINSBURY PAVEMENT,
LONDON, E.C.2. TEL: MON 9737
TELEGRAMS: ELGARCON, AVE., LONDON

"You wouldn't know the old Savings Group since Jim took over!"

In most concerns post-war changes of staff have found capable volunteers ready to take over Savings Groups; but here and there, sometimes unavoidably, groups have lapsed. It is in the interest of employers and employees alike that group savings should forge ahead, because a keen Savings Group is a sign of happy relationships, besides being a national asset. The more *you* can support your Savings Group the greater will be its success. Steady saving is as vital as ever.

New Groups

If you have no Staff Savings Group, will you get one started right away? Every place of employment should have its own Group.

New Members.

If you have a Savings Group, will you do all you can to encourage the Staff to join?—'every employee a group member' should be the aim.

Facilities

Experience shows that the fullest facilities induce the highest Savings. Ask your Local Savings Committee or Assistant Commissioner for details of the various schemes.

Savings Clubs

These are the ideal way of saving for holidays, Christmas or other special occasions. Clubs are popular, easy to run and need not interfere with your Savings Group.

Information, equipment and publicity material are provided free of charge—apply to your Local Savings Committee or to the National Savings Committee, Sanctuary Buildings, Westminster, S.W.1

It's easier to save in a

STAFF SAVINGS GROUP

Issued by the National Savings Committee

TIME AND MOTION

A Study For The Office As Well As The Factory

Man-power is the most expensive item in any business overhead. That is why most progressive businesses embody time-and-motion-study experts. But more in the factory than in the office.

Yet where is more time wasted than in any average office? Or where is the pay-per-hour relatively highest? Look around you now: how many people are busily occupied on non-productive work? Looking for something. Checking facts. Finding information.

What is the solution? Visibility! Keeping everything within "eyeshot." Seeing what you want as soon as you want it. Not searching, digging, thumb-fumbling.

Look at the illustration below. The main illustration shows Shannograph as a general filing system. Note that each folder is individually hung—metal on metal. Each folder has a full-width FLAT TOP for typing full name, address, phone number and other desirable details. And each folder is colour-charted so as to make misfiling impossible.

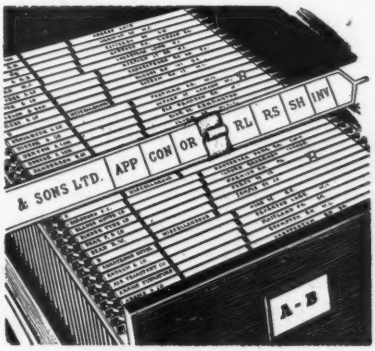
The strip illustration shows one only of the many specialised Shannograph adaptations. This is a typical set-up for "progressing" Export orders. On the left is the usual filing information (and number, if filed numerically). On the right are sections for progressing sequences of action (these can be done by dates if preferred).

Here is a typical coding:

App—Application RL—Receipt of License Del—Delay
Con—Confirmation RS—Receipt of Shipping Instructions
Or—Order in hand SH—Shipped Inv—Invoiced

The SIGNAL is placed over "DEL," indicating a delay

Think of the many adaptations possible in *your* business—for sales, advertising, accounting, buying, etc., etc. Why not let your filing do these double duties?



Shannon Systems

THE SHANNON LIMITED

429, Shannon Corner, New Malden, Surrey

Mica Lubricant and Filler . . .

N.S.S.A. Steam-water Ground Mica is a white paper filler and lubricating coating for other fillers to enhance their flow and thermal and electrical insulating properties.
Use as filler in paper to be coated with resin or varnish, then build up and press, roll or mould.
Coat ordinary mica powder with N.S.S.A. and then use as a filler for moulding powders to make them heat resisting and more reliable electrical insulators. Ideal filler for Plastic moulding powder and rubber.

Samples and Prices on Application
Technical Data

The Wall Paper Manufacturers Ltd.
MICA BRANCH
GRESHAM RD., OSMASTON RD.,
DERBY

Telegrams: MICABRANCH, DERBY
Telephone: DERBY 45761

STEELE-SHAW
PEBBLE MILLS

For the grinding of all kinds of Powders, Chemicals, Minerals, Colours, Paints, Enamels, etc. Supplied lined with hard Porcelain, Silex or special linings, and can be insulated to suit particular classes of work.

Send for our free illustrated literature.

STEELE & COWLISHAW, LTD., *Engineers*
(Dept. No. 27). COOPER STREET, HANLEY, STOKE-ON-TRENT.
London Office: 329, High Holborn, W.C.1.
Telephone: Holborn 6023.

Nearly ½ a Century's Experience in Grinding

PLASTIC TOYS

Old-established firm of Toy Factors, with unrivalled Sales Organisation, is prepared to undertake Exclusive Agency for Manufacturers producing cheap Plastic toys. Write to

LOUIS GOLDBERG LIMITED
GAS STREET (Broad Street)
BIRMINGHAM, 1
'Phone: MID. 0088

W. PAGE & SONS
PACKAGING SPECIALISTS

ALL SIZES OF NEW AND ONCE USED CARTONS SUPPLIED FROM STOCK

Please see our advertisement in classified columns for full details.

34, LANGSIDE CRESCENT, SOUTHGATE, N.14. *PALMERS GREEN 5087 & 9916*

TOOLMAKERS & DESIGNS (Coventry) LTD.
BRAYS LANE, COVENTRY. Telephone: COVENTRY 4051/2.

TOOLMAKERS TO THE ENGINEERING AND PLASTICS INDUSTRIES

The foundation of success in mouldings rests on first-quality Moulds. Our reputation ensures first-class returns to our clients. Repeat orders prove it! We design and manufacture compression-transfer-injection moulds of highest quality and finish. Jigs, fixtures, gauges, press tools, special-purpose machines, etc. Limited capacity also available for high-class batch production work.

Let US have YOUR enquiries for "that" job.

"NEVER FORGET YOUR Sternocleanse!"

We shall be pleased to see you at Stand 81 at S.B.A.C. Exhibition, Radlett, Sept. 9—14

FREE WORKS POSTERS

like this advertisement will constantly remind your workers of dermatitis dangers. The words "Sternocleanse Posters" written on your noteheading and posted to us will bring you details of STERNOCLEANSE, the anti-dermatitis cream, and its round-the-year Works Poster Scheme.

Your Guard against DERMATITIS - if used ALWAYS

STERNOL LTD • ROYAL LONDON HOUSE • FINSBURY SQUARE • LONDON E.C.2 • MONarch 3871-5

Is YOUR VOLTAGE all over the place?

Why not make your process heaters independent of voltage fluctuations?

The Energy Regulator maintains constant input to heaters despite normal or abnormal variations of voltage.

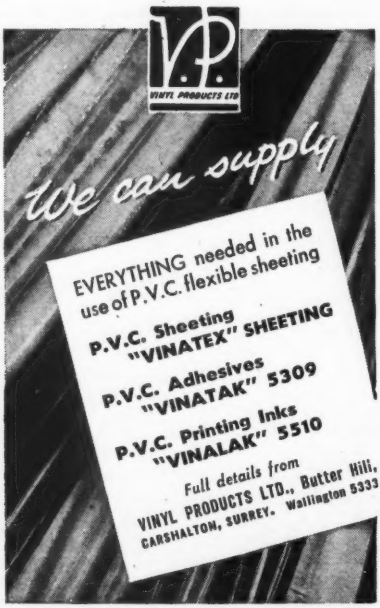
Prevent spoilt batches by fitting Energy Regulators in place of control resistances. The Type ER.3 unit controls up to 3.5 kW. at 230 V. A.C. or D.C.

Full details in publications R.12/51 and ER.10/51. WRITE NOW!

SUNVIC CONTROLS LTD.
Stanhope House, Kean Street, London, W.C.2

SUNVIC

TAS/SC167


V.P.
VINYL PRODUCTS LTD
We can supply
EVERYTHING needed in the use of P.V.C. flexible sheeting
P.V.C. Sheeting "VINATEX" SHEETING
P.V.C. Adhesives "VINATAK" 5309
P.V.C. Printing Inks "VINALAK" 5510
Full details from
VINYL PRODUCTS LTD., Butter Hill, CARSHALTON, SURREY. Wallington 5333

ALMEX LIMITED

78-82, EXCHANGE BUILDINGS, STEPHENSON PLACE, BIRMINGHAM, 2.
Phone: Midland 0682.

CUPREX LIMITED
Finsbury Pavement House, 120, Moorgate, London, E.C.2.
Phone: Metropolitan 9641.

ALMEX LIMITED
26, Corporation Street, Manchester, 4.
Phone: Blackfriars 0301.

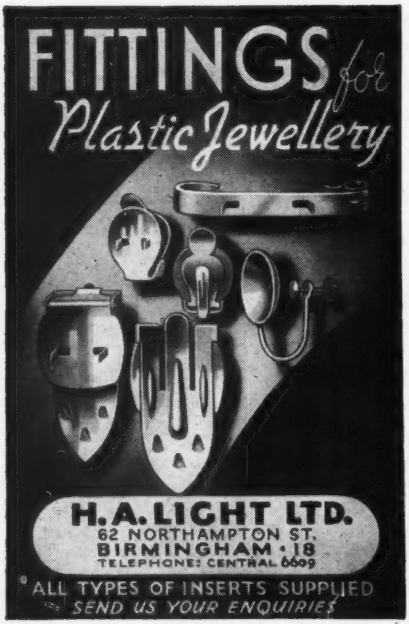
Stockists of **I.C.I. "PERSPEX" ACRYLIC SHEETING** and **I.C.I. "CRINOTHENE"**

We undertake the cutting and edge polishing of **"PERSPEX"** sheeting to customers' requirements.

We can also **DYE** your **"PERSPEX"** sheets or finished articles to any required transparent colour.

We supply **CELLULOSE ACETATE** and **POLYSTYRENE** injection moulding powders for quick delivery for use on export goods only.

P.V.C. and **POLYTHENE** available for home trade.



KEEP THINGS MOVING —

FLOWLINE **YOUR OUTPUT**

Whatever you are packaging, transporting, assembling or processing, remember it's "faster on a Flowline." The Flowline Standardised Conveyor System is mechanical handling in its simplest, most efficient, and most economical form. Write for FLOWLINE Handbook: Fisher & Ludlow Ltd., Gridway Division, Dept. 9, 110/111 Strand, London, W.C.2. 'Phone Temple Bar 2755.

clear or coloured
transparent or opaque
plain or printed

SELLOTAPE solves the trade moulder's difficult problem of counting and grouping an infinite variety of mouldings of different shapes and sizes for packing and despatch. No more bothersome discrepancies to aggravate customers and harass overworked staffs. Let us show you how SELLOTAPE can serve you in this and other ways . . . No obligation, of course.

GORDON & GOTCH LTD.
Dept. PL. 4, 75/79, Farringdon Street, London, E.C.4.

Sellotape
SELF-ADHESIVE CELLULOSE TAPE

EVERYTHING AT COMPETITIVE PRICES AND IMMEDIATE DELIVERY

ALL KINDS OF
PLASTIC BOTTLE CAPS & COSMETIC CONTAINERS
(ANY SHADE)
READY NOW for EXPORT and HOME MARKET

'Phone: SPEEDWELL 5222
'Grams: BANARSE, GOLD, LONDON

P. S. BANARSE & CO. (PRODUCTS), LTD.
MANUFACTURERS OF COSMETICS AND PLASTIC GOODS
ALSO PLASTIC MOULD MAKERS

Office Address:
176, GOLDERS GREEN RD., LONDON, N.W.11.
Works Address:
34 MOZART ST., QUEENS PARK, W.10.

LIPSTICKS (3 SHADES), COLD CREAM, HAIR OIL
AND **12 VARIETIES** OF
EXOTIC PERFUMES

ALL FOR EXPORT - IMMEDIATE DELIVERY

RAW MATERIALS FOR PLASTICS & LACQUER INDUSTRIES

NITRO CELLULOSE SOLUTIONS
NITRO CELLULOSE in all forms
CELLULOSE ACETATE in all forms
POLYSTYRENES
POLYTHENE, etc.
PERSPEX SCRAP

Samples and technical information gladly on request

ALFRED HARRIS & CO. LTD.
Reclaimers and Refiners
TOWNSHEND TERRACE, RICHMOND
Telephone: Richmond 0028-9, Surrey

WANTED—STOCKS for CASH

WE are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus Stocks; in fact, goods of all kinds can be disposed of through us, without delay, on the most favourable terms, and without trouble.

SHOULD you have anything for disposal, either now or at any future time, please send us samples, full particulars and price on a cash settlement basis.

RELIANCE TRADING COMPANY
Wholesale Warehousemen and General Merchants
13, New College Parade, Finchley Rd., London, N.W.3

PLASTIC MOULDINGS AND CASEIN TURNINGS

To your particular requirements

FREDERICK W. EVANS, LTD.
PLASTIC WORKS, LONG ACRE, BIRMINGHAM 7.
TELEPHONE:—EAST 1286 and 1287.

VALUATIONS

of
INDUSTRIAL & COMMERCIAL PROPERTIES, PLANT, MACHINERY & EQUIPMENT
for the purpose of
Insurance Cover, Balance Sheet, Sale or Purchase.

CHAMBERLAIN & WILLOWS
23, Moorgate, London, E.C.2.
CITy 6013 (6 lines).

M.C.M. (TOOLS) LTD.

DESIGNERS & TOOLMAKERS
FOR
COMPRESSION, TRANSFER AND INJECTION MOULDS.
JIGS AND FIXTURES.

LET US SOLVE YOUR DIFFICULTIES

M.C.M. (Tools) Ltd.,
12, DENMARK ST.,
ASTON,
BIRMINGHAM, 19.

Octopus

ELECTRIC WIRING SYSTEM for FACTORIES, OFFICES AND HOUSES
APPLICABLE TO ANY SYSTEM OF BUILDING
Write for illustrated brochure to
PROVED AND PRODUCING PROPERTIES Ltd.
5, Cheapside, London, E.C.2, or
HARTLEY ELECTROMOTIVES, LTD.,
57, Victoria Street, London, S.W.1

Pioneers!

in MOULDS for MODERN PLASTICS
also Press Tools, Jigs and Gauges.

BARBER & DUFFY LTD
214/222, Cardigan Road, LEEDS,
Telephone: LEEDS 52033
Member of the Gauge and Toolmakers' Association.

IMMEDIATE CAPACITY

AVAILABLE FOR . . .

MACHINING, PUNCHING & STAMPING OF—
laminated paper and fabric base
Plastic materials and Perspex.

FABRICATION OF PERSPEX FOR—
lighting, general industrial
and other purposes.

MICA PRODUCTS LTD. ENGINEERS IN PLASTICS
1, DOWNS PARK ROAD, DALSTON, LONDON, E.8
CLISSOLD 0524 (8 lines)

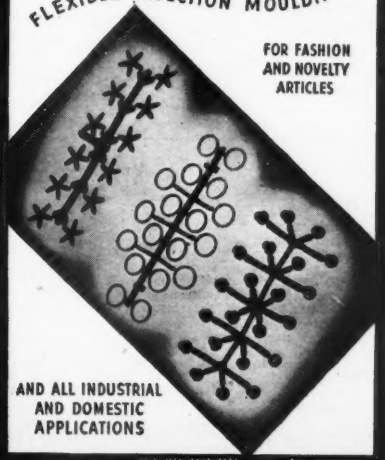
What is it

that aids
identification
simplifies grouping
assures accuracy
provides safe
attaching and
speeds movement?

It's
TRANSOTAPE
self-adhesive cellulose tape
May we send you specimen roll?

John Gosheron & Co Ltd
GAYFORD ROAD LONDON W12

KENUTUF
FLEXIBLE INJECTION MOULDINGS



FOR FASHION AND NOVELTY ARTICLES

AND ALL INDUSTRIAL AND DOMESTIC APPLICATIONS

J. F. KENURE, LTD., FELTHAM, MIDDLESEX

"That stoker-demonstrator certainly eased our fuel problem"

"I LOOK AT IT like this—a stoker is a key man these days. Just think what a really responsible job he has: it is in his hands to keep the factory going on less fuel.

"Some of the men are willing to go to classes and really get to understand the fine points of the job. But it's excellent to have a specialist instructor come down and give them an intensive course right in their own boiler-house . . . scientific firing, draught-control, banking and all the rest. You'll find that these stoker-demonstrators are welcomed as practical chaps. Believe me, we've proved the idea for ourselves and it really has been most worth while . . ."

★ *THOUSANDS OF FIRMS have taken advantage of this free Stoker-Demonstrator service. For many it has resulted in a major gain in fuel efficiency—with a corresponding effect on production. Ask your Regional Fuel Engineer for full details.*

HERE ARE OTHER SERVICES AT YOUR DISPOSAL

1. *Free advice from fuel engineers.*
2. *Instructional classes for boiler-house personnel.*
3. *Evening classes for executives, boiler attendants and maintenance stoff.*
4. *Advice and help in setting up joint fuel efficiency committees for works.*
5. *Publications (e.g. Fuel Efficiency News, special bulletins, leaflets, posters, etc.).*
6. *Fuel efficiency films, slides and film strips.*

YOUR REGIONAL FUEL OFFICE

REGION	ADDRESS	TELEPHONE
Northern	Government Buildings, Ponteland Road, Newcastle-on-Tyne, 5	Newcastle 28131
North-Eastern	Century House, South Parade Leeds, 1	Leeds 30611
North-Midland	Castle Gate House, Castle Gate, Nottingham	Nottingham 46214
Eastern	Shaftesbury Road, Brooklands Avenue, Cambridge	Cambridge 56268
London	Mill House, 87/89, Shaftesbury Avenue, W.1	Gerrard 9700
South-Eastern	Oakfield Court, Grove Hill Road, Tunbridge Wells	Chatham 3238
Southern	Whiteknights, Earley, Reading	Reading 61491
Wales	27, Newport Road, Cardiff	Cardiff 9234
South-Western	12/14, Apsley Road, Clifton, Bristol, 8	Bristol 38223
Midland	Temporary Office Buildings, Hagley Road West, Birmingham, 17	Bearwood 3071
North-Western	Burton Road, West Didsbury, Manchester, 20	Didsbury 5180-4
Scotland	145, St. Vincent Street, Glasgow, C.2	Glasgow City 7436
Scotland	51, Cockburn Street, Edinburgh, 1	Edinburgh 34031
Scotland	1, Overgate, Dundee	Dundee 2179

ISSUED BY THE MINISTRY OF FUEL AND POWER

CLASSIFIED ADVERTISEMENTS

Rate 4d. per word, minimum 4/-
— Box Number Fee, 1/- —

Instructions should be addressed to "Plastics," Bowling Green Lane, London, E.C.1

AGENCIES

Established firm of wholesale distributors, excellent connection southern counties, modern warehouse, wish to contact manufacturers of all types of plastics, either as agents or cash buyers. D. H. Ridout and Son, Ltd., 12 Stedman Road, Southbourne, Bournemouth. zzz-409

Agencies Wanted

Agencies wanted for the sale of plastic and Perspex articles. Offices operating from all large cities. Send particulars for cash on delivery to N. Gerver, Plastic Sales Dept., 2-10 Mare Street, Hackney, London, E.8. Phone, Amherst 5805 (five lines). 130-25

Going South Africa October, with various agencies, require additional agencies for manufactured articles. Box 499, care of "Plastics." 124-x9845

AUCTIONEERS' ANNOUNCEMENTS

RICHARDS AND PARTNERS.
AUCTIONEERS, VALUERS AND SURVEYORS
of
INDUSTRIAL PROPERTY, PLANT AND MACHINERY,
GRANVILLE HOUSE, ARUNDEL STREET, LONDON, W.C.2.
Phone, Temple Bar 7471 (four lines). zzz-408

WITH VACANT POSSESSION.
STERLING WORKS,
PONDERS END, MIDDLESEX.
A modern Freehold Factory.
Attractive offices. All services.
Covered area approx. 12,500 sq. ft.
Land for extension.
FOR SALE BY AUCTION.
in the
CITY AUCTION HALL,
58 COLEMAN STREET, E.C.2,
on September 30, 1947.
Full particulars from
CHAMBERLAIN AND WILLOWS,
23 MOORGATE, E.C.2.
City 6013. 124-11

DESIGN AND DRAWING

Product designing. We can style and prepare working drawings of the article you have in mind for production. Quotations given upon request.
Design Industries, Kent House Station, Beckenham, Kent. Sydenham 5281. 124-701

Plastics designers. Components, moulds, tools and plant planned, designed and detailed. Alex S. Godfrey, 64a Clapham High Street, London, S.W.4. 125-2216

Design and drawing capacity for plastics moulds (injection, compression, transfer) and component design development. Graystone Designs, 35 Winchester Road, Hampstead, N.W.3. Phone, Pri. 7420. 124-33

MACHINERY, TOOLS AND PLANT

Cockerham, Spencer and Nesbit, Ltd., Manor Buildings, Crawsham Hill, Pudsey, Nr. Leeds. Makers of dies for injection moulding. Your inquiries invited. Box 8680, care of "Plastics." 124-x4653

One Mitchell electrically heated drying cabinet, with indicating-type thermostat.
One 6 by 8 rotary cutter, with standard feed hopper and chute-type magnetic separator 18 ins. wide.
One electric pump, ½ h.p. 400/440v. Brook motor.
One polishing machine with dust extractor, 1 h.p. 230v. Brook motor, automatic starter.
18 polishing machines, mounted, some automatic, and some self-starters.
Two unmounted polishing heads, 1 h.p. 230v. and 440v.
One S.H.3 injection-moulding machine, hydraulically operated, 10 h.p. motor drive. Box 9728, care of "Plastics." 125-2196

Hot plates, steam heated, size 11 ft. 6 ins. by 5 ft. by 1¼ ins. thick, pressure 100 lb. per sq. in. Photograph. F. J. Edwards, Ltd., 359 Euston Road, London, N.W.1. Euston 4681. 124-5

Machinery, Tools and Plant (contd.)

FOR SALE.

Stainless Steel Enclosed VACUUM REACTION KETTLES or STILLS, approx. 1 ft. 10 ins. by 2 ft. 4 ins. deep, bolted top cover with manhole and glanded agitator entry, stainless steel agitator; mild steel outer jacket 50 lb. per square inch steam pressure, crown wheel and pinion fitted to agitator shaft; drive from fast and loose pulleys, bottom outlet, suitable for small-scale synthetic resin manufacture.

REED BROTHERS (ENGINEERING), LTD.,
BEVIS MARK HOUSE,
LONDON, E.C.3.
Phone, Avenue 1677-8. Grams, Replant Ald London. 126-3004

Four-impression 7¼-in. dressing-comb mould, at present in use.
Four-impression mould for bag combs, two of 6 ins. and two of 5¾ ins., at present in use.
Six-impression 6-in. dressing-comb mould, new 1947.
Eight-impression 5-in. pocket-comb, shaped back, brand new.
All moulds made for Reed Prentice injection-moulding machines, but are easily adaptable. Would prefer sell lot, but divide if necessary. Deferred terms if desired. Box 507, care of "Plastics." 124-10

One 12-19-ton Daniels moulding press, complete with double-plunger hand pump and 10-in. electrically heated platen; also one similar press, complete with 10-in. steam-heated platen. Both presses are brand new. Inclusive price, £300. Winkler Products, 154A Broadlands Road, Southampton. 124-1

Two sets hydraulic pumps, by Fielding and Platt, nearly new, horizontal, approximately 200 gallons per minute at 1,750 lb. per sq. in., reduction gear 730 to 120, motor 290 h.p., 400/3/50. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14. zzz-448

Automatic temperature controllers for sale, each suitable for controlling three moulding machines, range 0-400 C., complete panel and equipment by Foster Instrument Co., ready for use. Josalex, Ltd., Mill Works, Bury Street, Ruislip, Middx. 124-6

Bakelite press, double manually operated pump, gas-fired platens, 14-in. by 14-in., 8-in. ram, 12-in. stroke, 2½-in.-diameter side columns, 2½-in.-diameter screwed columns to adjust daylight to 12-in.-20-in. stroke. Can be seen at Messrs. G. P. A., Ltd., Albert Works, Albert Road, Wood Green, N.22. Phone appointment Bowes Park 1165. 124-x7

3-oz. T.M.A. Mark III injection moulding machine, fully hydraulic. £1,200. Four-impression 5½-in. fine- and coarse-teeth pocket comb mould (T.M.A., Ltd.), £3,000. Harrison Carter 9-in. grinding mill (3½ h.p. motor), £60. Both machines have had very little use. All items must be sold, preferably as one lot. Call, write, or phone, North Midland Plastic Products, 148, Siddals Road, Derby. Phone 45502. 124-32

Machinery, Tools and Plant, Wanted

Krause or similar blocking and embossing press wanted urgently, only perfect condition. Please send details immediately to Box 9752, care of "Plastics." 124-2202

100-ton hydraulic down-stroke plastic presses (self-contained) required, complete with electrically heated platens. Blackfriars Precision, Ltd., 154-6 Blackfriars Road, London, S.E.1. Phone, Waterloo 4369, 6454. 125-x8988

PRODUCTION CAPACITY AVAILABLE AND WANTED

Pulverizing and grading of raw materials, Dohm, Ltd., 167 Victoria Street London, S.W.1. zzz-369

Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 125-8451

Wanted, plastic articles of every description for export and British Isles. Representatives active in all parts. Can place large orders for export. Write N. Gerver, Plastic Dept., 2-10 Mare Street, Hackney, London, E.8. 131-394

Work wanted, tool room available for all sorts of press tools. Press work, assembling, spraying and all sorts of engineering to your design. Universal Components, Ltd., 19 Sunderland Terrace, W.2. Bay 6776. 131-392

We are able to undertake certain short or long runs of highly specialized medical and technical plastic moulded products. Injection, compression or sheet fabrication. Use our services for the preparation of prototypes. All inquiries strictly confidential. Box 7678, care of "Plastics." zzz-422

Injection moulding capacity available on 3-oz. injection moulding machine for short and long runs. Box 9035, care of "Plastics." zzz-438

Production Capacity Available and Wanted (contd.)

Perspex. Wanted firm experienced in flattening curved material to carry out substantial quantity of this work for owners. Box 9861, care of "Plastics." 124-2225

Firm of repute have capacity available for injection mouldings on 8-oz. Reid-Prentice machine, own design and tool-making departments, inquiries invited for long runs of mouldings in polystyrene, particularly for export, materials in stock. Box 516, care of "Plastics." 124-13

Offers invited from actual manufacturers only of P.V.C. sheeting, embossed and plain, .018 to .022, for export and Home trade. Please submit samples and details to Box 256, care of "Plastics." 124-x9041

Advertisers wish to make contact with a reliable firm which has the experience and capacity for the production of substantial quantities of wound elements for electric irons, toasters, kettles, etc. Box 505, care of "Plastics." 124-8

Embossing and Reproducing of wording and designs on plastics, leathers, cards and all materials carried out. L.I.S.T., Ltd., Fernhead Works, Fernhead Road, London, W.9. 126-3006

Capacity available, plastic mouldings up to 4 ozs., preferably mould supplied. Box 225, care of "Plastics." 124-x8909

Specialists in diemaking and flypress work, have capacity for moulding in c.a. sheeting or similar. Impression printing in extensive colour range effected to any designs on wide range of materials. Box 583, care of "Plastics." 124-25

Capacity for design-manufacture of press tools, moulds, jigs, fixtures, repetition turning, springs and presswork. The Super Ease Tool Co., Highfield Works, Oakley Road, Redditch. 124-24

Well-established Plastic Consulting Engineers with extensive offices and practice in the Midlands area, requires offers of further practice or agencies. Box 9041, care of "Plastics." 124-29

Plastic Specialist requires large or small contract in Perspex, cellulose acetate sheets or tubes, P.V.C. sheets or wired tube. We have specialized knowledge in work of the following natures: Office equipment, Perspex fancy goods, plastic cartons, control knobs, acetate tube bending, acetate and P.V.C. sheet manipulation, plastic covering of metal parts. Box 9042, care of "Plastics." 128-28

Injection moulding specialists have moulding capacity up to 4 oz. Consultants on all injection moulding problems. Please send inquiries to Box 9761, care of "Plastics." 124-30

Mouldings in ebonite, rubber and plastics. Modern factory has production capacity available. Inquiries invited for contracts with or without customer's own moulds. Box G2562, W. H. Smith and Son, Ltd., Manchester, 3. 124-2194

RAW MATERIAL AVAILABLE AND WANTED

Perspex. Several tons clear Perspex, ⅛ in. to ⅝ in. thick, in various curved uniform shapes. Also quantity of broken discs in small and large pieces. Inquiries invited for minimum 2-cwt. lots. Box 9862, care of "Plastics." 124-2223

Perspex. Clear bulk buyer wanted for 5 to 10 tons of broken pieces. Submit offer. Can be seen in London. Box 9863, care of "Plastics." 124-2224

Wanted, plastic sheeting in all thicknesses from 1-16-in. to 1-in. Can place large orders for home and export markets. Please submit samples and prices to N. Gerver. 2-10 Mare Street, Hackney, London, E.8. 125-393

CUPREX, LTD.,
Stockists of I.C.I. Perspex.
Offer specially:
1/16-in., ⅛-in. and ¼-in. coloured.
Write for stock list and particulars to:—
FINSBURY PAVEMENT HOUSE,
120 MOORGATE,
LONDON, E.C.2. zzz-446

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. zzz-445

Perspex for Sale, new sheets, offcuts, large and small scrap, powders; clear and colours. Box 9024, care of "Plastics." 124-696

Regular supplies of imported plastics available: Urea, polystyrene, cellulose acetate, luminiscent cellulose acetate, ethyl cellulose, phenolic, moulding compounds, phenolic resins and adhesives, extruded polystyrene rods, celluloid in sheets, rods and tubes, cellulose acetate in sheets, casein sheets and rods, P.V.C. extrusion compound. Please send inquiries to Box 9205, care of "Plastics." zzz-442

Raw Material Available and Wanted (contd.)

Bakelite sheets, 50, 1-16-in. thick, black P/HP perf., new, to clear stock at 3s. 3d. per lb. Box 9751, care of "Plastics." 124-2203

P.V.C. clean strippings from cables, etc., blue, brown, red, yellow and black, first-class material, large quantities available, 1s. 6d. lb. Box 9744, care of "Plastics." zzz-443

For sale, P.V.C. scrap. Offers invited. Box 8494, care of "Plastics." zzz-426

Cellulose acetate scrap urgently required; best prices paid. Write, Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. Phone, Metro. 9641-5. zzz-424

Perspex cut to requirements. Denny, 271 High Street, Acton, W.3. Acorn 5777. 125-2193

Perspex acrylic sheet. Stockists offer good range in clear and coloured. Stock lists available. J. H. Berry (Plastics), Portland Works, Annesley Woodhouse. East Kirkby 2151. 127-2195

Cellulose acetate scrap for sale, ton lots. Box 9753, care of "Plastics." 124-2189

PERSPEX.
Official Stockists
OFFER CLEAR AND PASTEL SHADES IN STANDARD SHEETS OR CUT TO SPECIFIC REQUIREMENTS;
Also
MOULDINGS OF ALL TYPES IN PERSPEX.
SYNTHENA, LTD.,
AKED STREET, VICAR LANE, BRADFORD.
125-2191

"Perspex" brand Acrylic sheet, new paper covered, clear and coloured, 1/16-in. to ½-in. thickness, in standard sizes. Box 9931, care of "Plastics." 125-x8651

Acetate sheets, transparent smoky, suitable for sun-glass discs, tennis or anti-glare visors, etc., 30/000 thick, approx. 4 cwt., 7s. per lb. Box 511, care of "Plastics." 124-19

For sale, polythene injection moulding powder, natural and coloured, for good delivery. Box 210, care of "Plastics." 124-18

For sale, cellulose acetate .010-in. sheeting, 22 ins. wide, opaque pastel colours. Box 210, care of "Plastics." 124-17

For sale, cellulose acetate injection moulding powder, limited quantities available for Home market. Box 210, care of "Plastics." 124-16

Perspex clear, paper covered, 36 ins. by 36 ins. by 3/16 in., 7/32 in. and ¼ in., for disposal. Write Box 515, care of "Plastics." 124-14

Perspex. Ashdowns, Ltd., Eccleston Works, St. Helens, have quantities of clear and coloured for disposal. 124-12

For disposal, P.V.C. scrap, plain printed, assorted colours, approx. 2 ton monthly, applications invited. Apply Box 504, care of "Plastics." 124-17

Wanted, "Perspex" sheeting, all thickness, coloured and clear, in any sizes, multiple of six over 12 by 12; coloured and clear "Perspex" off-cuts; coloured 10-thou. cellulose acetate, suitable for lamp-shade making; large or small quantities purchased. Box 580, care of "Plastics." 126-3040

Large quantities of clean polythene, white, black and other colours, segregated. Box 9865, care of "Plastics." zzz-449

For sale constantly, cut-offs of ¼ and 1/16-in. natural Holoplast, from 1s. per lb., according to size of pieces. Larks Spraying process, Monument Hill, Weybridge. 124-23

JOHN F. MANN, LTD.,
DIRECT IMPORTERS OF MOULDING POWDERS.
Offer
UREA FORMALDEHYDE.
PHENOL FORMALDEHYDE.
POLYSTYRENE, etc., etc.
Prompt and forward delivery
143 CANNON STREET, LONDON, E.C.4.
Phone, Mansion House 1270.
125-2998

Urea formaldehyde moulding powder for sale, 15 tons immediate delivery, at 2s. 11d. per lb. carriage paid. Sample of powder on application; also large quantities of phenol formaldehyde at 2s. 6d. per lb., in black, walnut, red and green. Box 513, care of "Plastics." 127-3000

Raw Material Available and Wanted (contd.)

Urea formaldehyde moulding powder, ivory offered ex-stock. Box 512, care of "Plastics." 125-2999

Plastic boards, 1/16 in., specially treated, highest artistic finish, suitable for panelling, furniture, bath, splash-backs, etc.; plain colours or marble effect, and wood (oak, mahogany, walnut, etc.), sheets 8 by 4 cut to requirements. Prompt deliveries. Larks Spraying Process, Monument Hill, Weybridge. 124-22

For immediate disposal: 30 tons half-hard aluminium sheet, new, imprest pattern one side, 6 ft. by 3 ft. and 6 ft. by 2 ft., 18 gauge. Box 581, care of "Plastics." 124-21

Plasticised P.V.C. compounds for extrusion, sheeting, moulding, etc., virgin grade, available for immediate delivery in wide range of opaque and translucent shades. Inquiries invited for plastic compounds for all purposes. East Anglia Chemical Co., Ltd., Street One, Aycliffe Trading Estate, near Darlington. 125-3005

Perspex and Crinothene, official I.C.I. stockists for North-West area, invite inquiries for flat sheet Perspex, clear and coloured, from 1/16-in to ½-in. thickness; also official I.C.I. stockists of Crinothene. Plastics (Manchester), Ltd., 11 Whitworth Street, Manchester, 1. Phones, Central 0272 and 1725. zzz-447

2,117 lb. new cellulose acetate moulding powder (seven colours) at 3s. 9d. per lb. 197 lb. C.A. scrap (first injection) colours at 1s. 6d. per lb. All items must be sold, preferably as one lot. Call, write or phone, North Midland Plastic Products, 148 Siddals Road, Derby. Phone 45502. 134-31

Perspex sheets, coloured and clear, standard sizes or cut to your requirements, deliveries from stock, offcuts also available, write for stock list. Box 9762, care of "Plastics." 125-2200

Moulding powders. If you have any redundant stocks for disposal contact us and also give us your inquiries if you are in need of supplies of other powders. Box 9756, care of "Plastics." 125-2201

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-410

We are now able to supply an adhesive suitable for cementing the Perspex which we supply. Inquries to Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. zzz-429

For sale, 15 tons P.V.C. black compound (recovered); samples available. Write to Cuprex, Ltd., Finsbury Pavement House, 120 Moorgate, London, E.C.2. zzz-428

Wanted, plastic waste and plastic piece goods. Send particulars, stating quantity and price. Box 6695, care of "Plastics." zzz-400

Perspex off-cuts, clear and coloured, cut to required size, lactoid rods and all forms of scrap plastic material; immediate delivery. Write, Plastic Department, J. E. Hoare, Byton Chambers, Amen Corner, S.W.17. zzz-399

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene, P.V.C. cuttings and other thermoplastic off-cuts and scrap? Having been in use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. zzz-395

SITUATIONS VACANT

Shorthand Typists, Private Secretaries, Clerks, etc., If you are in urgent need of staff, contact Embassy Secretarial Employment Bureau, Excel House, Whitcomb Street, W.C.2. Whitehall 5924. We specialize in efficient personnel. 124-8069

Toolmakers required for moulding tool work, experience essential. First-class craftsmen need only apply; top rate of pay to the right men; five-day week. Send full details to Seaforth, Watchett Works, Oakhurst Road, Southend. 124-693

Foreman required to take charge of small expanding plant processing thermo-plastic raw materials; experience of grinding, mixing, drying, pigmenting and thermo-plastic sheet manipulation an advantage. Good prospects, permanent position. Write, giving details of experience and salary required, to Box 9034, care of "Plastics." 124-694

Working toolroom foreman required by small firm in Essex. Experience in production of moulding tool work essential; five-day week. It is essential that applicant has sound organizing experience and ability and is a keen disciplinarian. Well-paid position for the right man. Send fullest details of past experience to Box 9026, care of "Plastics." 124-700

Plastics Chemist. Vacancy exists in Birmingham for qualified Plastics Chemist in Development and Research Department. Primary duty to investigate application of Plastics to products of old established Company. Apply stating age, qualifications, and salary required to, Box 9759, care of "Plastics." 125-2199

Situations Vacant (contd.)

FIRM IN THE PLASTICS INDUSTRY
(Southern Counties)
HAVE THE FOLLOWING VACANCIES IN THEIR RESEARCH LABORATORY:—

Qualified CHEMIST for work on organic problems.

Qualified physical CHEMIST.

Qualified PHYSICIST for research in industrial Applied Physics.

Well-paid positions with good prospects for the right men. Applicants are invited to submit in strict confidence full personal particulars, including experience and salary expected, marking letter of application with position they are applying for, Box 9750, care of "Plastics." 124-2198

Wanted: Plastics Executive with thorough experience and technical background for the further commercial development of existing Plastics Department in a firm who are already doing substantial business in plastic materials and moulding powders. Write with full details of experience and salary required to, Box 509, care of "Plastics." 124-15

Graduate in Chemistry or Physics required for technical service and sales work on plasticiser applications; some commercial experience desirable but not essential; should be able to work closely with applicational research groups. Write, giving full details to: Home Sales Manager, Monsanto Chemicals, Ltd., Victoria Station House, London, S.W.1. 124-4

Wanted, first-class technical representative, fully conversant with and capable of estimating the cost of production of jigs, fixtures, press tools, plastics mould, etc., to keep medium-sized works in Coventry area fully supplied with orders. Good salary and prospects for real live man who can show results. Only men with exceptional contacts amongst buyers need apply. Box 514, care of "Plastics." 125-3001

Technician required for development work on moulded track carbon potentiometers. Applicants must have had several years' experience in the plastics moulding industry, and should possess a good general technical background, preferably with a knowledge of electronics. Post is in the Swindon area and carries good prospects of advancement. Age 25 to 35. Salary according to experience, in region of £500. Please write, giving full particulars to Box 503, care of "Plastics." 126-3002

Diesinker Engraver required by firm engaged on plastic mould work in Essex; person with experience is offered a permanent progressive and well paid position; send fullest details to Box 508, care of "Plastics." 127-3003

Toolmaker required. Experience on plastic mould work essential. Person with experience is offered a permanent, progressive and well-paid position. Send fullest details "Seaforth," Watchett Works, Oakhurst Road, Southend. 127-3045

Sales representative with experience of industrial plastics and moulds required by London firm. Part-time commission basis would be considered. Box 523, care of "Plastics." 124-27

Salesman already calling on exporters required to handle new plastic lines. Write, Box 524, care of "Plastics." 124-26

SITUATIONS WANTED

Moulding shop foreman seeks similar position, 19 years' practical experience on compression and injection, first-class references. Home or abroad. Box 9019, care of "Plastics." 124-x6024

Sculptor, freelance, models all kinds of designs. Box 502, care of "Plastics." 124-6

Export Manager with world-wide connections, excellent organizer with inventive ideas, seeks change. Box 506, care of "Plastics." 124-9

Formaldehyde Chemist seeks change, 25 years' practical experience, including design and erection of plant; thorough knowledge of Continental processes. Box 426, care of "Plastics." 124-x9600

Works Supervisor, specializing injection moulding, good knowledge compression, experienced mould designer, costing, labour control, etc., desires change area, London preferred, not essential before October 6th. Chance increase knowledge extrusion welcomed. Box 496, care of "Plastics." 124-x9844

TIME RECORDERS

Factory time recorders. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., 157-159 Borough High Street, S.E.1. 125-8459

WANTED

Advertiser will exchange Urea blue, red and orange powder for black general purpose phenol. Box 554, care of "Plastics." 124-x8

MISCELLANEOUS

Extend Your Trade. Use a Trade Mark. Consult Trade Mark Protection Society 12 Church Street, Liverpool. 130-9745

Huts. Nissen type, 36 ft. by 16 ft. and other sizes; also other industrial buildings suitable for workshops, canteens, site offices, clubs, etc. No licence required. Write, phone or call (open Saturday afternoons). J. Thorn and Sons, Ltd., Box 138, Brampton Road, Bexleyheath, Kent. Phone, Bexleyheath 305 zzz-430

Photography by Behr will show your product at its best. Ask for illustrated list. 44 Temple Fortune Lane, London, N.W.11. Speedwell 4298. zzz-436

We supply within 24 hours Golderstat Photocopies, the inexpensive reproduction of documents, illustrations, photographs, etc. Golderstat, 54 Golders Gardens, London, N.W.11. Spe 5643. 126-659

W. Page and Sons,
34 Langside Crescent, Southgate, N.14. Phone, Palmers Green 5087.
The following lines always in stock:—
Wooden boxes, 18 by 12 by 9, at 2s. 8d. each, 21 by 12 by 9 at 2s. each. With lids.
12 by 12 by 12 Australian butter boxes at 1s. 4d. each.
Large tea chests at 5s. 9d. each. Small tea chests at 4s. 6d. each.
Export cases in ½-in. timber all round, 30 by 17 by 14, at 12s. 6d. each.
Cartons. Large, medium assorted cartons sold mixed in approximately the following sizes:—20 by 12 by 12, 19 by 13 by 15, 21 by 14 by 13, 23 by 13 by 10½, 13 by 10 by 21, etc., etc.
5,000 lots and over at 1s. 3d. each. Under 5,000 at 1s. 4d. each. 30,000 in stock.
Small mixed cartons. Sizes range from 17 by 12 by 6 to 8 by 5 by 5, approximately. To-day's cheapest carton at 6d. each.
Thousands of others in stock. We would welcome your inquiries, which shall receive our prompt and courteous attention.
All goods free delivered in the London area, f.o.r. elsewhere. zzz-421

Engraved name plates, scales, dials, etc., supplied. Tickets and Co., Box 2, Silver Street, Leicester. 129-9541

Acid containers. High-quality ebonite containers available from stock, 29 gallons capacity, dimensions 17¼ ins. by 13½ ins. by 39¾ ins. high, suitable for handling and storing liquid chemicals, price £3 10s. each. United Ebonite and Lorival, Ltd., Little Lever, near Bolton, Lancs. 125-2190

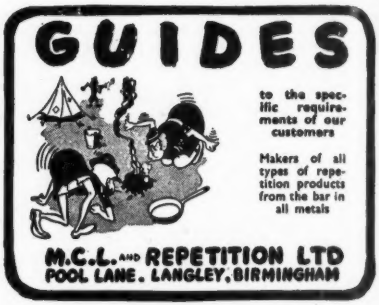
Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write, Monomarks, BCM/MONO76, W.C.1. 128-2192

Engraved direction panels in clear Perspex, reversed lettering filled in any colour. These can be suspended under a light, giving illuminated effect. Hotel-key labels, table numbers, lift panels, etc. Plastic and Metal Engraving Co., 26 Lower Richmond Road, S.W.15. 124-x9599

To all users of plastic materials, Almex, Ltd., announce that they are now in a position to undertake dyeing and tinting of articles manufactured of "Perspex" Acrylic sheet on a production basis. For samples and estimates, please apply to Almex, Ltd., Exchange Buildings, Stephenson Place, Birmingham, 2. Phone, Midland 0682. Stockists of I.C.I. "Perspex" Acrylic Resin sheet and I.C.I. "Crinothene." 124-3

Plastic playing cards. The method of manufacturing plastic playing cards and the method of coating ordinary cards with a plastic film are for sale. Box 7467, Sylvester Hvid, Advertising, Frederiksberggade 21, Copenhagen K., Denmark. 124-2

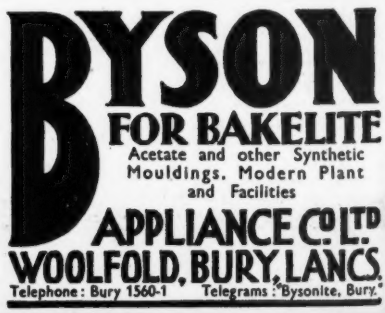
300 pairs gilt ear clips for sale, 7-16-in. flat base with two pegs, low price. Box 582, care of "Plastics." 124-20


GUIDES
to the specific requirements of our customers
Makers of all types of repetition products from the bar in all metals
M.C.L. AND REPETITION LTD
POOL LANE, LANGLEY, BIRMINGHAM

HENRY BUTCHER & CO.
AUCTIONEERS, VALUERS and SURVEYORS
Specialising in the Valuation and Sale of
FACTORIES, PLANT and MACHINERY
73, Chancery Lane, London, W.C.2
TEL.: HOLBORN 8411 (5 lines).

W. B. COLDWELL & SONS LTD.
DIESINKERS, MOULDS, JIGS.
DIPLOMA FOR DIE SINKING 1911
89-91, Rockingham Lane, SHEFFIELD, 1.
TELEPHONE: SHEFFIELD 24047

FOR RUBBER AND PLASTIC DIES OR MOULDS—AND SPECIAL MACHINES
the name is LAW for the rapid execution of your ORDER
F. W. LAW & Son Ltd.
CASTLE WORKS, MANCHESTER ROAD, ROCHDALE
TELEPHONE: ROCHDALE 3002.


BYSON
FOR BAKELITE
Acetate and other Synthetic Mouldings. Modern Plant and Facilities
APPLIANCE CO. LTD
WOOLFOLD, BURY, LANCS.
Telephone: Bury 1560-1 Telegrams: "Bysonite, Bury."

Printed in England and Published Monthly by the Proprietors, TEMPLE PRESS LTD., BOWLING GREEN LANE, LONDON, E.C.1.

Material Problems? . . .

. . . then consult CATALIN — the solution to many difficult problems. The cast thermosetting phenolic resin of unlimited potentialities, proved in a hundred and one industries. The material in which the prototype can be easily fabricated without incurring large tool costs.

CATALIN is supplied in rods, sheets, tubes, special profile sections; a wide range of glorious colours and mottles, opaque, translucent and transparent; is free working; easily machined; has good physical properties; odourless, tasteless, non-inflammable; resistant to alcohol and most acids.

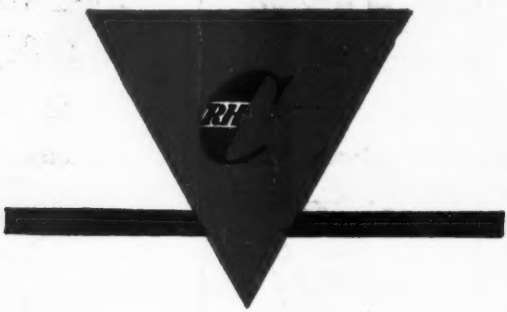
Associated Products:
CATACOL — cold or hot setting adhesive for wood, phenolic or cresylic mouldings.
CATAFORM for casting press tools.

Catalin
TRADE MARK REGISTERED

The Gem of Modern Industry

CATALIN LIMITED, WALTHAM ABBEY, ESSEX. *Telephone: Waltham Cross 3344*

SEPTEMBER, 1947. Vol. XI. No. 124 **Plastics** TWO SHILLINGS



Polystyrene Moulding Granules

manufactured at Sarnia, Ontario
by

DOW CHEMICAL OF CANADA LTD.

Agents in Great Britain

R. H. COLE & COMPANY LIMITED

STYRON

(Registered Trade Name)

available in a wide range of colours in addition to crystal

Immediate delivery from stock in London

R. H. COLE AND COMPANY LIMITED
2, CAXTON STREET, WESTMINSTER, S.W.1
Phone: Whitehall 0711/2/3 Grams: Geratole, Phone, London